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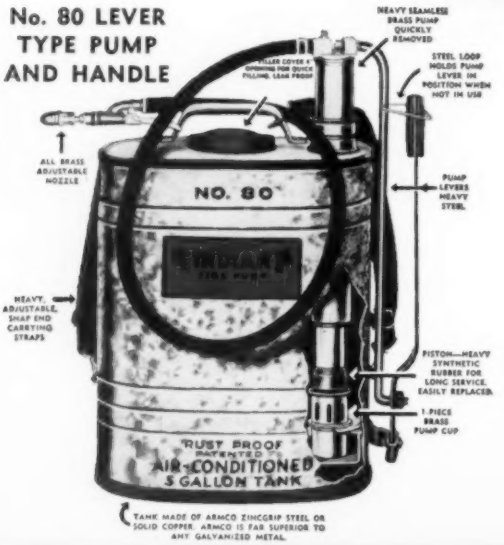
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CONTENTS

COVER: Graduate study—the further development of a trained professional mind.

Photo courtesy of Pennsylvania State University.

Some Factors Affecting Management of Conifers and Hardwoods in the Allegheny Region ..... *David W. Sowers* et al. 563

Effect of Controlled Release on Growth of Invidual Douglas-Fir Trees ..... *George R. Staebler* 567

Efficiency of Several Cruising Designs on Small Tracts in North Arkansas ..... *Clement Mesavage* and *L. R. Grosenbaugh* 569

Plantation Success in the Harvard Forest as Related to a Planting Site and Cleaning, 1907-1947 ..... *Stephen H. Spurr* 577

Georgia's New Dewinger ..... *S. P. Darby* 579

Effects of Prescribed Burning on Forage and Mast Production in Southern Pine Forests ..... *Daniel W. Lay* 582

Upland Hardwoods in South Arkansas Pine Stands—Aerial or Underground Fifth Column? ..... *R. R. Reynolds* 585

Financial Maturity—What's It Good For? ..... *John Fedkiw* and *James G. Yoho* 587

A Guide To Sources of Information Regarding Interesting Forestry Developments in The South 591

Notes 595

Mulch Not Beneficial to Seedlings on Deep Sands; Effect of Pruning of Ice Bent Slash Pines; A Syringe for Pine Pollination.

Points of View 599

The Education and Training of Foresters.

Reviews 600

Arctic Wilderness; Submission to Royal Commission on Canada's Economic Prospects; Publications of Interest.

Current Literature 602

Society Affairs 603

Forestry News 612

Index To Advertisers 624

MAKING WOOD SERVE AMERICA BETTER THROUGH GOOD FOREST MANAGEMENT

NELSON S. ROGERS (1891-1949), member, Society of American Foresters, author and teacher. As Oregon State Forester (1940-1949), he led movements for better fire protection and sustained yield legislation and also inspired rehabilitation of the Tillamook Burn — a project still under way. In 1955, part of the reforested area was dedicated as a state forest in his name.

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Journal of Forestry

Official Organ of the Society of American Foresters

Some Factors Affecting Management of Conifers and Hardwoods in the Allegheny Region[1]

David W. Sowers, et al[2]

WIDE SCALE interest among landowners in growing more conifers is apparent. Some forest managers consider hardwoods an economic liability and attempt complete replacement with conifers. Others seek methods of increasing the proportion of conifers in mixed stands, while some are content if they can maintain present proportions. In any case there is ample evidence that many owners have reached a decision as to what they wish to grow and that attempts to carry out that decision often fail to include consideration of natural factors which must be taken into account. The important factor of site is often ignored. Yet, management for any forest type or species must be based on a consideration of site to be successful. There are sites in the territory of the Allegheny Section (Delaware, Maryland, New Jersey, Pennsylvania, and West Virginia) that will grow excellent hardwoods, others that will grow excellent pine. To convert either results in only temporary success and high management costs.

In view of these considerations the Committee on Silviculture and Management of the Allegheny Section, S.A.F., presents the following discussion of the management of four types[3] found in the Section's territory. No attempt is made to consider details of silviculture or management of any one type, but rather to present consideration of the key factors on which successful management of these or other types may be based. These key factors are: (1) climate and location, (2) seedling establishment, (3) seedling growth, (4) stocking, and (5) harvesting and regeneration.

Virginia Pine—Southern Red Oak (S.A.F. Type 78)

Pure stands of Virginia pine occur mostly on abandoned fields, burned over areas, and the poorer soils of steep slopes and ridges of the northern Piedmont. Rarely is Virginia pine found in any quantity above elevation 1,500 feet. On the coastal plain this species competes very little with loblolly, while in the mountains west of the Piedmont more white, pitch and Table-Mountain pine, hemlock, and spruce occur. Better soils in the Piedmont, and areas that have never been farmed, produce upland hardwoods predominantly, with some admixture of Virginia pine. The predominant soil series in the Virginia pine areas are Chester, Penn, and Hagerstown. Climate is moderate, 180 growing days and 40 inches of rainfall per year.

Contrary to general belief, Virginia pine has peak seed years. Adequate amounts of seed are rarely disseminated more than 100 feet. Present knowledge indicates that scarification provides the best seedbed. Because Virginia pine is very intolerant, some means of hardwood control is necessary if the pine component of a mixed stand is to be increased. Competition from hardwood seedlings and sprouts, and even from herbaceous vegetation will greatly reduce the survival of Virginia pine seedlings.

Average stocking of Virginia pine ranges from nearly 1,000 trees per acre at age 20 to about 200 at 70 years. Thinning is effective only when done before the stand reaches 15 years of age. The rotation age for Virginia pine is about 40 years when grown for pulpwood. Biological maturity is about 70 years of age and saw timber may be cut from trees averaging 60 years old.

Associated upland hardwoods in the northern Piedmont, such as chestnut oak, northern red oak, other red oaks and white oak, with yellow-poplar on the better sites, can be managed with a rotation of 80 to 90 years. Present economic demand suggests favoring these species in the management of upland hardwoods. When pine is not to be favored in mixed stands, hardwood regeneration is best obtained by openings made through selective cutting of mature trees, individuals of poor quality, or species of low economic value.

While uneven-aged management is suitable for the upland hardwoods, either in pure or mixed stands, pure Virginia pine requires an even-aged system. Adequate regeneration is obtained through opening up the stand by clearcutting in patches or strips, with a maxi-

[1]Adapted from paper presented at the winter meeting of the Allegheny Section, Society of American Foresters, Feb. 10-11, 1956, held at Philadelphia, Pa. The theme of the meeting dealt with maintaining present pine volume in stands and increasing pine component of pine—hardwood stands.

[2]Report of the Committee on Silviculture and Management, Allegheny Section, S.A.F., consisting of Harold W. Geiger, Robert M. Gerfin, Joseph E. Ibberson, George R. Moorhead, Albert G. Snow, Joseph J. Truncer, Earl H. Tryon, Sidney Weitzman, and David W. Sowers, Jr., *chairman*.

[3]Type names and numbers used conform to "Forest cover types of North America" published by the Society of American Foresters, 1954.

mum distance from an adequate seed source of about 100 feet. Seed trees of Virginia pine or a two-aged system of leaving standards has not generally proven feasible because of the lack of wind-firmness of this species.

In view of the above, we can be fairly certain of growing continuous crops of Virginia pine in pure stands, provided we confine efforts to the cleared areas and poorer soils of the lower and middle slopes of the northern Piedmont, and if we employed an even-aged system of management. Some sort of hardwood control to prevent gradual encroachment of hardwood species of the oak-hickory type will be essential. Scarification, controlled burning, or a combination of the two, will ensure seedbed conditions for the pine crop following final cut.

To attempt to introduce or increase Virginia pine in the coastal plain loblolly sites would be foolish because of the faster growth and higher economic value of loblolly. To do the same on better soils of the northern Piedmont would be to invite a ceaseless and expensive fight against upland hardwoods and white pine, which are better adapted to such sites, and which will have an increasing rather than decreasing value as time goes on, if grown on sites conducive to high vigor, form, and size.

Shortleaf Pine—Oak Type (S.A.F. Type 76)

This type differs from the Virginia Pine—Southern Red Oak type in that it contains significant quantities of pitch, shortleaf and Table-Mountain pine in addition to, or in place of, Virginia pine. The type is found in various topographic locations, ranging from the ridge and valley areas of the Allegheny Mountains south and east through the Piedmont and coastal plain of New Jersey and Delaware. In some areas the type is more indistinct than in others, due probably to the history and pattern of land use over the years. Generally speaking, excessively wet and poorly drained soils are not conducive to this type. In New Jersey Atlantic white-cedar occupies about 15 percent of the type area in the more swampy places.

Rainfall over the area averages from 30 to 45 inches annually with slightly higher precipitation in the mountains. Temperatures vary from a low of —12° F. to the 90's, mean annual temperature being 45-55° F., maximum growing season 176 days.

Soils of this type are light and sandy in the coastal plain, principally of the Cohansey formation. In the Piedmont areas and foothills are predominantly clay loams from shales and sandstones. DeKalb, Muskingum, and Porters are the predominant soil series for this type.

Good seed years are relatively scarce in this type, occurring about every ten years. However, the supply is usually ample provided seedbed conditions are favorable.

The hardwoods in the coastal plain part of the type are scrubby and relatively worthless, so the type is best managed there for its pine component. This can best be done by using prescribed burning. The oaks should be allowed to mature rather than be cut when young, since sprouting ability is much less in older trees.

Even in the Piedmont and mountain areas some form of seedbed preparation is advisable to insure adequate natural regeneration of pine. Tree-length logging with crawler tractors tends to open up mineral soil for better seedbed conditions, but without prescribed burning this method will improve the seedbed for hardwoods as well as for the pine.

Advance reproduction of pine becomes established through use of prescribed burning and shows a substantial gain even while burning is being used.

All of the pine in this type except shortleaf will tolerate little competition from hardwoods. Consequently a cleaning or weeding operation on the hardwood sprouts is necessary 5 to 8 years after a cutting in which hardwood has been removed, if the pine is to continue to grow.

Site conditions are reflected in both seedling establishment and growth, with moisture being the limiting factor.

Stocking appears to depend on past cutting practices as well as on the history of uncontrolled fire and grazing. Quality of unmanaged stands is usually quite low due to highgrading in previous cuts. Normal stocking can be figured at 10,000 to 12,000 bd. ft. per acre. The amount of pine reproduction five years after cutting has been found by Little to increase at the rate of about 500 seedlings per acre for every prescribed burn made before cutting.[4]

Moderately heavy thinnings are recommended to improve the hardwood component of this type, including chemical control of the undesirables where no market for them exists. Clearcutting, leaving seed trees, should be practiced where pines predominate and are desired in greater quantity in the next stand.

Rotation age will depend on whether it is desired to maintain principally hardwood or pine. A rotation age of 80 to 100 years is recommended in the areas where red and white oaks are valuable and where site is conducive to growth of hardwoods. Intermediate thinnings can be used to yield smaller diameter products.

Where the hardwood is of poor form and vigor and the site is better suited to pine, rotation age should be about 40 years, with pulpwood the principal product. A fully stocked stand will yield in the neighborhood of 35 cords per acre. Thinnings made at 20 years of age will yield about 8 cords per acre.

Although bark beetles are the chief danger to the pines, proper cutting practices to keep individual trees of thrifty condition will help to reduce this hazard. The oak wilt probably presents the greatest current danger to the

[4] Little, Silas, Jr. Prescribed burning as a tool of forest management in the northeastern states. Jour. Forestry 51: 496-500. 1953.

hardwoods of this type. Control measures should be followed. Some tip moth occurs on the pines but is not serious. Browsing by deer on young pine seedlings is a factor and may retard rotation age as much as three years. As soon as the pine fiber toughens up, the deer cease to be a factor as they browse only on tender shoots.

White Pine—Northern Red Oak—White Ash (S.A.F. Type 20)

This type occurs naturally over large areas of the Allegheny Section, particularly in northern Pennsylvania, western Maryland, and eastern West Virginia. The hardwood associates include beech, sugar and red maple, basswood, sweet and paper birch, white oak, yellow-poplar, aspen, black and pin cherry and hickory. In some parts of its range white pine is associated principally with the oaks. There is not much evidence of white pine regenerating in some parts of the northern hardwood type. The type is found at elevations of 1,500-3,000 feet, and higher in parts of West Virginia. Annual precipitation varies from 25 to 50 inches, more commonly nearer the lower figure. In the southern part of its range the topography is rough, the stands growing on the slopes of long mountain ranges, made up of folded trata with drainage of the trellis pattern. The soils are often thin and derived from shales and sandstones, though best development is made on moist sandy loam soils.

In the northern third of Pennsylvania the white pine was originally found in pure stands on deep soils created by glacial action. Clear-cutting and fires almost eliminated the species and the area was taken over by hardwoods. Where a seed source was left, white pine is now coming back on these deep soils, forming the present type.

White pine seeds every two or three years, although heavy seed years are less frequent. A moist mineral soil seedbed resulting from scarification usually gives best germination results, for both pine and hardwoods. White pine seed will disperse in quantity, 500 to 1,000 feet on the slopes, but dissemination usually is less than 100 feet from crop trees growing on the level. Seedlings seldom die from drought but heat from direct sunlight is probably the chief factor which affects germination and kills very small seedlings.

TABLE 1.—SEEDING HABITS OF THE BEECH—SUGAR MAPLE TYPE

Species	Frequency of good seed years	Average number of seeds per pound	Season of seed dissemination
Beech	Every 2 to 3 years	1,600	After 1st heavy frost
Yellow birch	Every 1 to 2 years	450,000	November-February
Sugar maple	Every 3 to 6 years	6,000	October-December
Hemlock	Every 2 to 3 years	190,000	September-Winter

Little is known as yet about the seed year periodicity of most hardwoods in this type. Oaks regenerate abundantly when a heavy seed crop occurs but 5 to 15 years may elapse between such crops.

Although less site preparation is needed for most hardwoods than for white pine, some reduction of humus depth appears to be beneficial to hardwood seedling establishment. Most hardwoods are able to withstand competition during seedling growth better than the pine, even though white pine is the most tolerant of the pines. And most hardwoods, while they tolerate more shade than the white pine, require removal of heavy overhead canopy before growing at a suitable rate.

When logging a stand of this type at maturity for the purpose of getting a new crop through natural reproduction, decision must first be made as to whether pine or hardwood will be favored.

A fairly heavy selection, small group selection or the shelterwood method is recommended for hardwoods such as oak and hickory. Large group selection or shelterwood cuttings made in winter during heavy seedyears are most advantageously employed when favoring white pine in this type. These methods are favorable to regeneration, minimize loss from windfall, and lower the danger from infestation from the white pine weevil. They are adapted to result in a sequence of favorable conditions for germination and seedling growth which are: to initially allow a minimum of direct sunlight to reach the forest floor, and to increase the direct sunlight as the seedlings grow larger.

In general, the use of clearcutting or the seed-tree method should be avoided for either the white pine or the hardwood, particularly in locations where the soils are thin and erodable, as is the case in parts of Maryland and West Virginia.

White pine can, and should be, favored to a greater extent than it has been, as it has more value than most of the hardwoods with which it is associated. The very important factor of site should not be overlooked, especially in planting programs. White pine has been planted in the past on sites which are much less suited to it than to some other species. Control of blister rust is underway in most of the territory where the type is found.

In contrast to the Virginia pine—Southern Red Oak type where present knowledge indicates management either on an even-aged basis for Virginia pine or on an uneven-aged basis for hardwood, and to a greater extent than much of the Shortleaf Pine—Oak type, the White Pine—Northern Red Oak—White Ash type is more adaptable to management that will permit growth of both hardwood and white pine. This is due to the greater tolerance of white pine than any of the other pines. Judicious handling of the group selection or shelterwood methods with some control of hardwoods for favoring pine in the seedling stage will result in both hardwood and pine regeneration. The proportion of pine will be determined to a large extent by the size of openings made in the group selection method. Seedbed scarification would also help pine.

Beech—Sugar Maple (S.A.F. Type 60)

This type occurs mostly on cool moist sites. Major associates are yellow birch and hemlock. These sites are commonly found along streams, especially in ravines, as well as at the higher elevations. Although the type grows well on thin soils with many boulders, the trees reach their maximum growth and development on deep, moist, well drained soils.

The four species of this type vary in their seeding habits (Table 1).

Yellow birch has the largest range of dissemination. Under ideal conditions the tiny seeds can be blown for long distances across the heavily crusted snow. The range of dissemination of seed of the other species depends largely on the size of the seed. Beech nuts, of course, almost all germinate within a short distance of the parent tree.

The amount of reproduction is not a problem in this type. There are usually many seedlings on the ground even under an overstory. Neither beech nor mape are demanding as to the condition of the seedbed. Seed from both species can germinate and the seedlings become established even through a dense leaf litter. Seed from the birch and hemlock, on the other hand, need a seedbed free from hardwood leaf litter. Best germination for these two species is found on moist rotten logs or on mineral soil.

Maple and beech seeds germinate into strong, sturdy seedlings. Newly germinated birch and hemlock seedlings are quite delicate.

None of the four species makes especially fast growth in the seedling stage. Beech, maple, and hemlock seedlings are very tolerant, so can hang on under the canopy of the faster growing intolerant species. Birch is less tolerant but faster growing.

All four of these species are long-lived, capable of growing to 200 years of age or more. And since they are quite tolerant they can perpetuate themselves in the stand. (The death or removal of one old veteran will provide sufficient light for the intermediate yellow birch to become established.)

Stocking in a virgin forest is probably about 20,000 board feet per acre, or in terms of trees 6 inches and larger, 140 sq. ft. of basal area per acre.

The silvicultural characteristics of this type make it ideally suited for practicing the selection system of management. This would call for a stocking of about 80 sq. ft. of basal area per acre in trees 6 inches and larger. On a board foot basis, this could amount to holding about 6,000 board feet per acre.

Actually, the type of cutting made in previously unmanaged stands of the type depends largely upon the present condition of stands. In most stands the first cut would be an improvement cut under the selection system. Where patches of old defective trees occur, group selection would be the best method. This is also the best system if it is desired to maintain or increase yellow birch reproduction. Where there is nothing but defective trees, it is probably best to clearcut and start over with a seedling stand.

Under the selection system, thinning can be carried on along with harvest cuts. In other words, the cut should be made throughout all diameter classes. Thinnings in the even-aged portion of the stand should probably be put off until they can pay their way.

In the first cuts under the selection system, the trees to be cut should be selected on the basis of vigor, form, and present or potential value rather than on the basis of age or species. However, it is not likely that many trees over 100 years of age would be kept in the stand. An exception to this would be in stands managed for veneer wood. Other things being equal, sugar maple should be favored over beech. Not only is beech slower growing and of lower value, but it is also susceptible to attack by the beech scale-nectria complex. This epidemic has already reached the Catskill Mountains of New York, and could become a problem in the Allegheny Section in the not too distant future.

In making any cut, care should be taken not to expose the residual birch trees too much. Birch is a sensitive species and suffers from post-logging decadence. Large old hemlock trees often have ringshake in their wood. This factor should be considered in marking the stand for cutting.

It is apparent from the foregoing that hemlock can be grown along with hardwoods in this type.

TABLE 2.—COMMON AND SCIENTIFIC NAMES OF TREE SPECIES MENTIONED

Common name	Scientific name
Ash, white	*Fraxinus americana*
Aspen, bigtooth	*Populus grandidentata* Michx.
Basswood	*Tilia* spp.
Beech	*Fagus* L. spp.
Birch, paper	*Betula papyrifera*
sweet	*Betula lenta*
yellow	*Betula alleghaniensis*
Cherry, black	*Prunus serotina*
pin	*Prunus pensylvanica*
Hemlock	*Tsuga* (Endl.) Carr.
Hickory	*Carya* Nutt. spp.
Maple, red	*Acer rubrum*
sugar	*Acer saccharum*
Oak, chestnut	*Quercus prinus*
northern red	*Quercus rubra*
southern red	*Quercus falcata* Mich.
white	*Quercus alba*
Pine, loblolly	*Pinus taeda* L.
pitch	*Pinus rigida*
shortleaf	*Pinus echinata* Mill.
Table-Mountain	*Pinus pungens* Lamb.
Virginia	*Pinus virginiana* Mill.
eastern white	*Pinus strobus* L.
Spruce	*Picea* spp.
White-cedar, Atlantic	*Chamaecuparis thyoides* L.
Yellow-poplar	*Liriodendron tulipfera*

The proportion of hemlock can be increased through improvement cuttings and releases.

Conclusion

Some forest types of which conifers are a component part with hardwoods can be managed so as to increase the proportion of coniferous stocking in the stands. In other conifer-hardwood types, such as Virginia Pine—Southern Red Oak and to a lesser extent the Shortleaf Pine — Oak, present knowledge and experience indicate that a choice must be made as to whether management is for pine or hardwood predominantly. This choice should be dictated by site characteristics, and no attempt should be made to encourage a species on a site which is inimical to its best development. A full consideration of how the key factors mentioned above influence the species being dealt with will in large part frame the management plan for any particular type and the place the component species may hold within the type.

Effect of Controlled Release on Growth of Individual Douglas-Fir Trees

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Pacific Northwest Forest and Range
Experiment Station, Forest Service,
U. S. Department of Agriculture

THIS paper presents preliminary results of a "spot-thinning" study in a 41-year-old, well-stocked, Site IV, Douglas-fir stand on the Wind River Experimental Forest in southwest Washington. The experiment, installed in the spring of 1952, is designed to evaluate the effect of different degrees of release on dominant, codominant, and intermediate trees.

Methods

A one-chain grid was laid out in approximately 14 acres of the stand. At each grid-point, the nearest dominant, codominant, or intermediate tree was chosen that had at least three competitors. To be a competitor, a tree had to be a dominant, codominant, or intermediate, and be nearer to the subject tree than D+2 feet where D equals the d.b.h. in inches of the competitor.

Four treatments of three crown classes are involved: 0, 1, 2, or 3 competitors cut around 10 each dominant, codominant, and intermediate trees. Thus the experiment includes 120 study trees. The number of competitors to be cut was chosen at random and trees cut were "chief" competitors, determined by observation. Crown classes of study trees were selected in rotation at consecutive grid points, i.e. dominant, codominant, intermediate, dominant, codominant, etc.

Diameters of the study trees were measured at time of treatment and again in September 1955 after 3 growing seasons. Total heights were measured in 1952, but not in 1955. More complete measurements, including height, will be made after 5 years' growth record is available.

Results

In the 3 years following treatment, dominants grew more than codominants and codominants more than intermediates as might be expected (Table 1). More important is the change in growth with treatment, the data indicating a progressive increase in growth from 0 to 3 competitors cut. The difference is greatest between no cutting and 1 competitor cut, and least between 2 and 3 competitors cut. Within crown classes other than dominant, growth does not follow such a neat pattern, although in every crown class the growth is least where no trees were cut.

Analysis of variance shows that differences among crown classes and among numbers of competitors cut are highly significant.[1] The interaction between crown classes and number of competitors cut (i.e., the tendency for release effects to change in going from one crown class to another) was not significant.[2]

In a supplementary analysis, regression of diameter growth over d.b.h. was calculated for each of the four treatments, pooling the crown class data (Fig. 1). The regression for 1 competitor cut is substantially above the control (0 competitors cut) and 2 compet-

[1]One percent level test.
[2]Five percent level test.

TABLE 1.—AVERAGE 3-YEAR DIAMETER GROWTH BY CROWN CLASS AND NUMBER OF COMPETITORS CUT

Competitors cut	Crown class Dominant	Codominant	Intermediate	Average[1]
Number		*Inches*		
0	.69	.43	.19	.44
1	.72	.56	.29	.53
2	.94	.48	.33	.60
3	1.05	.48	.31	.62
Average[1]	.85	.48	.28	.55

[1]Averages weighted by the number of trees represented in each crown and treatment class.

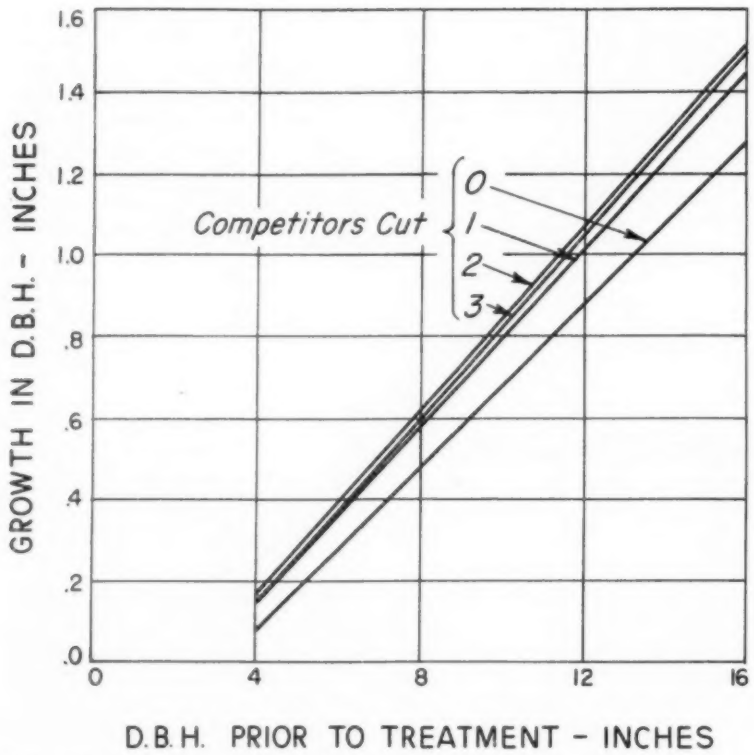

FIG. 1.—Three-year diameter growth by d.b.h. for each of the treatments.

itors cut is well above 1 competitor, but the 3 competitors cut regression is practically identical with that for 2.

When measurements were made in 1955, nine trees either had died or had suffered broken tops and were omitted from the calculation.[3] These losses are almost certainly a result of thinning since they were confined to codominant and intermediate trees that had been released. No further attempt at analysis was made for this preliminary report.

Growth is strongly related to d.b.h. within the crown class and treatment classifications. Some of the differences in growth within a crown class, apparent from Table 1, are due to larger or smaller trees in one treatment than in another. This fact is not accounted for by the analysis of variance technique. More refined analysis has not been made because of the short growth period involved and the preliminary nature of this report.

[3]Analysis of variance was made using disproportionate subclass frequencies. The null hypothesis becomes: "Crown class and release do not affect the growth of trees *that survive the measurement period.*"

Discussion

This experiment is designed to use individual trees for observation, rather than some unit area as in more usual thinning trials. It insures close control of the thinning treatment applied and permits evaluation of the treatment on trees occupying different positions in the stand. Consequently, the results have more than usual meaning in understanding the reactions of trees to thinning. Continued observation should add considerably to the type of information required for the formulation of scientific marking rules.

Although these preliminary results are based on only three years' growth following treatment, they already reveal interesting and significant trends.

Dominant trees, which often are thought to grow at the maximum rate possible for the site, have responded well to release in this well-stocked, Site IV stand. In fact, Figure 1 shows that the greatest response, in terms of inches of increased growth, occurred on the largest trees—that is, toward the dominant end of the scale. Apparently the better developed crown and root system of large (dominant) trees permits them to make better, or at least more immediate, use of the increased room from thinning.

It must be kept in mind, however, that in dense stands such as the one in which this study is located, dominant trees are not so well differentiated from the lower crown classes as in stands less well stocked nor, perhaps, as in stands on higher sites. That dominant trees had at least three competitors is evidence that even they were crowded.

The point of diminishing returns is reached quickly as release is increased. Cutting 1 competitor increases growth substantially. Cutting 2 increases it still more, but not twice as much. Little added growth results from cutting 3, rather than 2, competitors. However, the effects of heavier release may be more lasting so that where the interval between thinnings is long, cutting 3 competitors may prove superior to lighter treatments.

Efficiency of Several Cruising Designs on Small Tracts in North Arkansas

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Accuracy and efficiency of timber cruises are affected independently by the choice of plot arrangement and plot size. For any given tract being cruised for a given purpose, there is one arrangement and one plot size which is optimum for that tract and that cruising purpose. This study evaluated the effects of these factors on accuracy and efficiency of cruises of small tracts in the Ozark mountains of north Arkansas and the rolling terrain of north Louisiana. Plot arrangement is discussed in Part I of this article, and plot size in Part II. Part III compares efficiency of three alternative cruise designs applied to a larger tract in north Arkansas.

Part I. Plot Arrangement

Estimates of timber volume are usually based on measured sample plots located at regular intervals along equally spaced lines run across the area being cruised. A very common system, the "ten-percent survey," utilizes one-fifth acre plots spaced two chains apart on lines ten chains apart. In a mechanical arrangement such as this the ratio of distance between plots to distance between lines is 1:5. This arrangement is cheaper and more expedient than a random arrangement of a similar number of sample plots, but its sampling error is greater and the sampling error of a single grid can only be approximated (by methods such as those suggested by Hasel,[2] Osborne,[3] or DeLury[4]). Cruisers often are unable to calculate whether the loss in accuracy is outweighed by the reduction in cost.

To study this problem on small tracts in north Arkansas, a comparison was made of the efficiency of 3 plot arrangements, two systematic and one random. One systematic pattern located plots at the intersections of a 1:1 square grid, and the other at the intersections of a 1:4 rectangular grid whose shortest dimension tended to cross major topography.

The general conclusion was that the 1:1 grid was usually most efficient, i.e., that it tended to be more accurate for a given cost, or cheaper for a given degree of accuracy.

Plot-arrangement study method.—The study tracts were 12 areas on the Henry R. Koen Experimental Forest in Newton County, Arkansas. Each was 16 chains square, being comprised of exactly 25.6 acres. Tracts had previously been cruised and mapped 100 percent by 0.1-acre quadrats. Figure 1 shows the distribution of net Scribner board-foot volume on Area 2. Table 1 describes cover type, terrain, and volume distribution on all 12 areas.

Figure 2 illustrates the three types of plot arrangement tested on each of the 12 study areas. Each arrangement employed 16 square 0.1-acre sample plots. The plots of the square grid were 4 chains apart on lines 4 chains apart, while the plots of the rectangular grid were 2 chains apart on lines 8 chains apart. There are 16 possible non-overlapping systematic rectangular grids of this sort, and 16 possible non-grids. The initial point of a single systematic grid should, of course, be selected at random.

Accuracy.—The sampling error of a random sample may be calculated from the formula
In this formula:

$$SE = \left(\frac{C}{\sqrt{n}}\right)\sqrt{\frac{N-n}{N}}$$

[1]Stationed at Harrison, Ark., and New Orleans, La., respectively.

[2]Hasel, A. A. Sampling errors in timber surveys. Jour. Agr. Res. 57:713-736. 1938.

[3]Osborne, J. G. Sampling errors of systematic and random surveys of cover-type areas. Jour. Amer. Statis. Assoc. 37:256-264. 1942.

[4]DeLury, D. B. Values and integrals of the orthogonal polynomials up to $n = 26$. 33 pp. Univ. Toronto Press, Toronto, Ont. 1950.

Table 1.—Description, Mean Board-Foot Volume (Scribner) Per Acre, and Coefficient of Variation of Plot-Arrangement Study Areas

Area	Topography	Forest type	Average volume per acre	Coefficient of variation[1]
			Bd. ft.	*Percent*
1	Steep	Shortleaf pine on south slope, hardwoods on north slope	2,429	89.42
2	do.	do.	2,119	84.56
3	do.	do.	2,571	100.47
4	do.	do.	2,974	73.71
5	Moderate	Mixed pine, hardwoods and eastern redcedar	1,439	123.90
6	Steep	Principally hardwoods, some pine	1,256	146.67
7	Moderate	do.	1,496	107.82
8	Steep	Principally hardwoods	1,267	112.08
9	do.	do.	1,064	109.55
10	do.	do.	1,456	106.17
11	Moderate	Mixed hardwoods and eastern redcedar	443	169.98
12	do.	Principally eastern redcedar; some hardwoods	314	109.19

[1]For 0.1-acre units.

SE is the standard error or sampling error (expressed in percent of mean plot volume). C is the coefficient of variation of the individual plot volume, i.e., the square root of the mean squared deviation of individual plot volumes from the mean plot volume (expressed in percent of mean plot volume).

n is the number of plots.

N is the total number of sampling units in each tract, i.e., the total area of the tract being cruised divided by the size of one sample plot.

$\sqrt{\frac{N-n}{N}}$ is a correction factor for finite populations.

Application of this formula to cruises with random arrangement of plots presents no complications. To estimate sampling error in a cruise based on 16 randomized 0.1-acre plots, one need merely calculate the coefficient of variation from the plot data, and insert this into the formula. However, the estimate of coefficient of variation is itself subject to an error that decreases as the number of sample plots is increased. In this study, therefore, the coefficient of variation of 0.1-acre plots was not based on a random drawing of 16 plots, but on all of the 256 tenth-acres in each tract. This was possible because complete populations of plot data were available prior to testing, and use of all

66	176	218	241	305	564	0	232	222	293	359	276	85	0	0	0
440	13	514	609	159	435	161	157	221	176	0	565	109	159	78	0
48	162	282	447	0	292	301	242	689	874	434	176	123	105	66	0
0	86	144	434	306	337	207	66	142	407	201	471	0	342	406	200
66	0	317	217	306	185	134	396	0	126	448	0	290	218	0	205
0	117	226	76	57	167	181	257	97	199	0	50	122	144	0	97
165	281	294	0	284	313	237	0	122	222	50	165	259	48	111	76
230	112	159	60	0	247	87	182	128	199	48	81	0	0	163	128
0	423	172	111	57	0	86	244	57	0	146	323	50	152	277	97
215	122	109	233	422	135	0	183	48	363	0	133	0	114	0	590
157	140	97	195	325	657	48	220	48	162	76	57	154	383	326	263
144	457	0	147	516	86	173	0	229	0	66	111	425	226	289	594
204	361	427	180	1,335	66	162	0	114	124	166	559	244	132	336	183
403	18	77	145	502	0	76	165	334	153	149	557	340	284	381	434
310	111	493	267	0	202	172	291	93	399	365	303	252	463	361	593
396	126	603	239	308	198	452	318	298	157	142	449	238	468	408	559

FIG. 1.—Distribution of net Scribner board-foot volume on Study Area 2, by 0.1-acre quadrats.

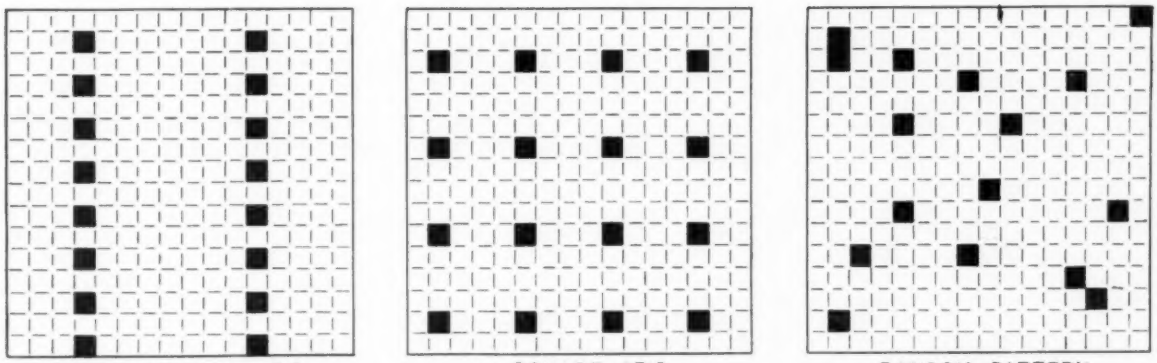
1:4 RECTANGULAR GRID
(1 out of 16 possible similar but non-overlapping grids)
1:1 SQUARE GRID
(1 out of 16 possible similar but non-overlapping grids)
RANDOM PATTERN
(1 out of $\frac{256!}{240!16!}$ possible random sets of sixteen)

FIG. 2.—Comparison of 16-plot patterns in 16 x 16 populations (1.6 acres sampled out of 25.6 acres).

the plot data resulted in the best possible estimate of sampling error for each tract.

The possession of complete information for each tract similarly made it feasible to get an unbiased estimate of sampling error of the systematic arrangements. Since each tract contained 256 sampling units, it was possible to assemble the data for 16 separate surveys, each containing 16 plots, without using the volume of any quadrat more than once. Such surveys were assembled for each of the twelve test areas, separately for each of the two systematic grids. By regarding an entire sixteen-plot survey as a single observation, the standard deviation of a set was calculated just as for a single 0.1-acre plot. This procedure obviously is possible only on research projects. Of course, it assumes a random choice of one of the sixteen grids.

Cost.—Cost was measured in terms of time required by a three-man survey team. Time was analyzed in a separate study (reported more fully in Part II), which showed that plot-location with hand compass and tape required 0.61 crew-minute per chain of travel. Time to measure a 0.1-acre plot varies with the nature of the cruise, timber stocking, and plot conditions. In this study, it was assumed to average 3 minutes per 0.1-acre plot, regardless of plot arrangement.

Total time included plot-measurement, which was constant (since each survey pattern had the same number of plots), and travel time, which differed between the patterns. Travel distance for the two systematic surveys was calculated as the length of the tract multiplied by the number of cruise lines, plus the length of one line to allow for necessary offsets. Distance of travel for the random survey was not similarly computed because it differed for each random pattern. However, it was determined empirically that the distance normally would be about the same as that required for a survey having a square plot spacing. Since delays are encountered in figuring courses from one location to the next, time allowed for travel in the random pattern was increased arbitrarily to 120 percent of that for the square spacing.

Total survey time (travel plus plot measurement) used in the comparisons was 96.80 minutes for the 4 x 4 survey, 77.28 minutes for the 2 x 8, and 106.56 minutes for the random survey.

Efficiency. — Survey efficiency must take into account cost as well as sampling accuracy. It is best thought of as being a function of the reciprocal of the product of the squared sampling error (expressed as percent) multiplied by cost; it is optimum when this reciprocal is at a maximum. Following Cochran,[5] the efficiency of one design (in this case the random) was taken as 100 percent for each tract, and the efficiencies of the other designs were expressed as percents of random efficiency. Thus, a 1:1 survey with an efficiency of 200 percent would have twice as much information (or a sampling error only $\sqrt{1/2}$ as great) as could be secured from a random survey having the same cost. Alternatively, a random survey of the same accuracy as the 1:1 would cost twice as much.

Results.—Table 2 shows the precision (sampling error) and efficiency of each of the plot patterns, by tract. The 4 x 4 arrangement was most precise in 5 of the 12 cases tested; the random was most precise on 4 of the tracts; the 2 x 8 was most precise on 3. The 4 x 4 survey was most efficient on 5 of the 12 tracts, the 2 x 8 was most efficient on 4, and the random on 3.

Table 2 shows that average sampling variation *between* 4 x 4 surveys tended to be *smaller* on 8 out of 12 tracts than sampling variation between random surveys involving the same number of plots. There is, however, an implied corollary which is less obvious: average variation between plots *within* a single 4 x 4 survey tended to be *larger* than random variation on 8 out of 12 tracts. This means that

[5]Cochran, W. G. Sampling techniques. 330 pp. John Wiley and Sons, Inc., New York. 1953. (See pp. 189 ff.).

TABLE 2.—PRECISION AND EFFICIENCY OF RANDOM SAMPLES COMPARED WITH 2 DIFFERENT TYPES OF SYSTEMATIC SAMPLES, WHERE 16 0.1-ACRE PLOTS WERE VARIOUSLY SELECTED ON EACH OF TWELVE DIFFERENT STUDY AREAS IN NORTH ARKANSAS

Study area	Precision or sampling error			Efficiency[1]		
	4 x 4 survey	2 x 8 survey	Random survey	4 x 4 survey	2 x 8 survey	Random survey (stand.)
	Percent			*Percent*		
1	15.94	25.35	21.64	203	101	100
2	18.95	17.12	20.47	128	197	100
3	26.23	34.48	24.32	95	68	100
4	17.89	21.19	17.84	109	98	100
5	27.07	27.33	29.99	135	166	100
6	24.92	21.18	35.50	223	387	100
7	24.26	30.76	26.10	127	99	100
8	21.76	30.15	27.13	171	112	100
9	23.57	20.45	26.52	139	232	100
10	33.05	34.93	25.70	67	75	100
11	35.82	40.20	41.14	145	144	100
12	40.18	47.75	26.43	48	42	100

[1]Efficiency = $\frac{(\text{Standard survey error in percent})^2 \text{ (total time for standard survey)}}{(\text{other survey error in percent})^2 \text{ (total time for other survey)}}$.

use of within-survey variation to estimate between-survey variation (or sampling error) will result in a doubly exaggerated estimate of sampling error in the case of the 4 x 4 systematic survey. For a random pattern, within-survey variation can be used to obtain an unbiased estimate of between-survey variation—the classical random-error formula is valid.

It should be noted that although the 4 x 4 survey tended to be more *precise* than the random survey in 8 out of 12 tracts, the 2 x 8 was more precise than the random survey on only 5 out of 12 tracts. Again, though the 4 x 4 survey was more *efficient* than the random survey on 9 out of 12 tracts (almost significantly so at the 5-percent level, by rank analysis) the 2 x 8 was more efficient than the random survey on only 7 out of 12 tracts. It appears that, in the 12 areas studied, the 1:1 square grid tended to give the greatest efficiency, and the 1:4 rectangular grid was somewhat less efficient. The precision of the 1:1 grid tended to be greater than that of a random sample involving the same number of plots, while the precision of the 1:4 rectangular grid was not notably different from that of a random sample.

For general cruising in areas similar to those tested, it would seem that the number of sample plots needed for a specified precision should be calculated as though the plots were to be located at random. If the plots are then located in a 1:1 square grid, both efficiency and precision should tend to be somewhat better than if plots are located at random. If they should be located in a rectangular grid no more compressed than 1:4, precision would not differ greatly from that of a random location, but cost would be somewhat less and hence efficiency might be slightly greater.

TABLE 3.—AREA BY COVER TYPE AND OPERABILITY FOR PLOT-SIZE STUDY AREAS IN KOEN EXPERIMENTAL FOREST

Compartment No.	Operability	Cover type				
		Pine	Hardwood	Redcedar	Non-forest	Total
		Acres				
16	Operable	4.1	13.2	2.2	0.0	19.5
	Inoperable	.5	14.8	4.8	.4	20.5
15	Operable	.0	4.3	5.0	.0	9.3
	Inoperable	.0	10.9	19.8	.0	30.7
14	Operable	2.0	8.2	3.3	.0	13.5
	Inoperable	.0	15.0	5.9	5.6	26.5
23	Operable	20.7	9.0	1.0	.0	30.7
	Inoperable	.8	3.1	0.6	4.8	9.3
28	Operable	4.4	17.5	3.6	.0	25.5
	Inoperable	.0	10.8	3.7	.0	14.5
27	Operable	5.3	12.3	2.5	.0	20.1
	Inoperable	.8	16.2	2.9	.0	19.9
26	Operable	5.5	24.4	.2	.0	30.1
	Inoperable	.7	9.2	.0	.0	9.9

Part II. Plot Size

Unbiased estimates of timber volume can be obtained with plots of any size, provided that their location is not biased. However, there may be a narrow range of sizes that will be most efficient. A common practice is to use a plot one-quarter or one-fifth acre in size. Optimum plot size can be regarded as determined by the same measure of efficiency as has been discussed earlier—the reciprocal of the product of the squared sampling error in percent multiplied by the cost. Plot size is optimum when efficiency is maximum. Optimum size may vary from one tract to the next, depending on the clumpiness of tree occurrence and the costs.

For cruises of operable saw timber on small tracts, i.e., tracts less than a section or so in size, this study indicates that optimum plot size is not greater than 0.1 acre. For pulpwood stands, the optimum may be appreciably smaller; for specialty products such as handle stock, or veneer and cooperage bolts, the optimum may be considerably larger.

Determination of optimum plot size for any given cruise is relatively easy, and is discussed below in some detail.

Plot-size study method.—Seven 40-acre compartments on the Koen Experimental Forest were selected for study. Data for an additional 40-acre tract in north Louisiana were contributed by the office at Russellville, Arkansas, of the Bureau of Land Management, U. S. Department of the Interior. Table 3 describes cover types and merchantability conditions on the Koen Forest units. Table 4 shows the volume per acre on all units.

Available information for each of the compartments was a 100-percent inventory, by 0.1-acre square quadrats. Volumes of these

quadrats were combined to provide three additional volume populations for each area in terms of three alternative plot sizes. These included, in addition to the basic 0.1-acre population, 0.2-, 0.4-, and 0.8-acre populations. The 0.2-acre plot size was rectangular (1 x 2 chains); the 0.4-acre was square (2 x 2 chains); the 0.8-acre was rectangular (2 x 4 chains).

Efficiency of each of the 4 plot sizes was calculated on the assumption that 8 acres out of 40 would be sampled at random by plots of the specified size, with the efficiency of the 0.1-acre plots as the base or 100 percent. Thus, sampling error was calculated using 80, 40, 20, and 10 sample plots, respectively, for the 0.1-, 0.2-, 0.4-, and 0.8-acre plot sizes. Table 4 gives coefficients of variation for plots of each size. The variation utilized the entire population of a given size of plot in each case.

Cost was measured in terms of total time needed to begin at one corner of a tract and locate and measure the requisite number of plots on theoretical intersections of a square grid (actual random location would, of course, require more time than the grid location assumed). Travel distance was therefore calculated as $(\sqrt{n}+1)L$, where n is the number of plots and L the length of the 40-acre compartment. Obviously, actual time will vary with locality and crew.

Data on travel and plot-measurement time were obtained from a 16-acre unit of the Sylamore Experiment Forest in Stone County, Arkansas. Topography of this unit was moderately rough. Mean volume per acre averaged 7,200 board feet (gross Scribner) of hardwoods. It was found that 0.61 minute was required per chain of travel for a three-man crew using hand compass and tape. Although plot-measurement time can vary widely, the ratio of time needed to measure a 0.1-acre plot to time needed for other plot sizes is relatively stable for any given set of conditions. On the Sylamore test, it was found that for each minute required to measure a 0.1-acre plot, there were

TABLE 4.—COEFFICIENT OF VARIATION Q (PERCENT OF MEAN PLOT VOLUME), RELATIVE SAMPLING ERROR, AND SAMPLING EFFICIENCY FOR 20 PERCENT CRUISES OF EIGHT 40-ACRE TRACTS

Compartment number	Species sampled	Volume per acre (Scribner)	Coefficient of variation				Sampling error				Efficiency			
			0.1-acre plots	0.2-acre plots	0.4-acre plots	0.8-acre plots	0.1-acre plots	0.2-acre plots	0.4-acre plots	0.8-acre plots	0.1-acre plots	0.2-acre plots	0.4-acre plots	0.8-acre plots
		Board feet	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
15	All	406	168.0	147.1	126.3	108.4	15.4	16.6	19.8	21.6	100	109	83	91
Do.	Cedar	181	137.0	108.6	93.9	73.9	13.7	15.4	18.8	20.9	100	101	73	78
Do.	Cedar	(1)	81.1	69.3	121.8	127.3	8.1	9.8	24.3	36.0	100	88	15	9
14	All	818	168.0	147.1	126.3	108.4	16.8	20.8	25.3	30.7	100	84	61	55
28	All	1,130	119.9	101.8	84.7	69.7	12.0	14.4	17.0	19.8	100	89	68	67
16	All	1,239	121.5	101.8	81.2	70.8	12.2	14.4	16.3	20.0	100	92	77	67
27	All	2,194	113.4	92.7	80.9	72.9	11.4	13.1	16.2	20.6	100	95	67	55
26	All	2,617	116.5	102.8	91.4	86.3	11.6	14.6	18.2	24.4	100	81	55	41
Do.	White oak	352	196.6	141.9	117.1	77.5	19.7	20.1	23.4	21.9	100	122	97	147
23	All	4,386	103.2	91.7	84.3	76.2	10.3	13.0	16.9	21.6	100	81	51	41
North Louisiana	All	4,042	72.7	55.4	45.3	34.6	7.2	7.9	9.0	9.7	100	86	89	100
Do.	Pine	2,281	118.8	99.8	82.2	66.3	11.9	14.1	16.5	18.8	100	91	72	73
Do.	Red oak-beech	760	139.5	140.8	93.4	75.5	14.0	19.9	18.7	21.4	100	67	77	77
Do.	White oak-yellow-poplar	467	178.6	131.5	86.0	65.5	17.9	18.6	17.2	18.5	100	126	148	169
Do.	Gum-hickory	534	163.0	129.2	93.0	63.1	16.3	18.2	18.6	17.9	100	159	116	165
Do.	Pine pulpwood	(2)	143.3	107.7	84.6	71.4	14.3	15.2	16.9	20.2	100	112	98	90

[1] 132 cubic feet.
[2] 54 cubic feet.

required, respectively, 1.61, 2.69, and 4.12 minutes for the 0.2-, 0.4-, and 0.8-acre plots (circular). On the 0.4- and 0.8-acre plots it was necessary to set stakes to mark the plot boundaries on four points, a procedure which required an additional 1.77 and 2.46 minutes respectively.

Plot-measurement time depended on the number of trees per unit area (a function of plot size), and the number of borderline trees whose inclusion or exclusion had to be settled by chaining (a function of plot perimeter, or $\sqrt{\text{plot size}}$). Hence, measurement time on large plots was not a simple function of plot size.

Measurement time for the 0.1-acre plot was set at 3 minutes. Times for the other plot sizes then became 4.83, 9.84, and 14.82 minutes, respectively. Table 5 shows the relative time-factors for each plot size.

Results.—Table 4 shows mean plot volume, sampling error of estimate for a twenty-percent cruise corrected for the finite population sampled, and the relative efficiency for each of the plot sizes tested.

The table indicates that with only one minor exception, the precision of estimates of equal intensity increases as plots are made smaller and more numerous. But total cost also increases, and efficiency does not increase unless the squared sampling error(in percent) decreases faster than cost increases. A well known cluster-sampling formula[6] expresses optimum plot size in terms of parametric variance between clusters of plots, variance within clusters, time per cluster (exclusive of measurement) and time to measure each unit per cluster:

$$M = \sqrt{\left(\frac{V_w}{V_b}\right)\left(\frac{T_b}{T_w}\right)}$$

This formula (M is the optimum number of plots per cluster) cannot be validly used to determine optimum plot size in this case, however, because variance between clusters of 2, 4, or 8 adjacent 0.1-acre plots varies with distance between clusters, which depends on number per cluster—the unknown element in optimum plot size. Nevertheless, the formula does help rationalize certain generalizations.

[6] Yates, F. Sampling methods for censuses and surveys. 318 pp. Hafner Pub. Co., New York City, 1949. 269-287.

TABLE 5.—SURVEY TIME FACTORS FOR 20 PERCENT CRUISES

Plot size (acre)	Sample plots per survey	Travel time	Plot-measurement time	Total time
	Number	*Minutes*		
0.1	80	121.3	240.0	361.3
.2	40	89.3	193.2	282.5
.4	20	66.7	196.8	263.5
.8	10	50.8	148.2	199.0

For the compartments examined, the 0.1-acre plot was more efficient than larger sizes in nearly all stands operable for saw timber, even though stocking was relatively light. In heavily stocked stands, there is good probability that even smaller plots—0.05-acre, for example—might be still more efficient, since $\frac{V_w}{V_b}$ would tend to grow smaller.

Where volume is low and dispersed in a few large trees, large plots are indicated since $\frac{V_w}{V_b}$ would tend to get larger. An example is Compartment 15, which contains a light stocking of overstory hardwoods and eastern redcedar. Larger plots may also be better for a single species group comprised principally of a few scattered large trees. The white oak component in Compartment 26 is a case in point. However, individual components which are more heavily represented are best sampled by the 0.1-acre plot. Thus, in the north Louisiana tract the 0.1-acre plot was more efficient for sampling either the relatively well-stocked pine or the red oak-beech components.

Low-intensity cruises of large areas tend to cause the ratio $\frac{T_b}{T_w}$ in the cluster-sampling formula to increase, so that optimum plot size will tend to increase in such situations. Because this article is based on results from small tracts, the implications will not be developed further.

Table 4 indicates that the conventional fifth-acre and quarter-acre plots are too large for cruising most of the 40-acre study areas, except where sparse, scattered stands of large timber (such as white oak) are involved, when they may be too small. It appears that considerable saving might occur from the use of optimum-size plots. Sampling individual trees with probability proportional to size might be a step in this direction.

Determining optimum plot size.—Unlike plot arrangement, the efficiency of alternative plot sizes can readily be ascertained in commercial practice. The following precruising procedure is suggested:

1. Obtain volume or basal area estimates on concentric circular plots having a range in sizes. Plots should be taken at each of a number of sample locations distributed over the area to be cruised.

Choice of plot sizes to be tested should depend on general stocking of the area. In well-stocked stands of merchantable saw timber, for example, 0.05-, 0.1-, and 0.2-acre plots would appear to be a good selection; for pulpwood estimates in young even-aged stands, a range of 0.0125, 0.025, and 0.05 acre is suggested.

Plot volume estimates need be based only on a tally by d.b.h. classes. If suitable volume tables based on d.b.h. are not available, the test may be based on ΣD^2 (the sum of the squared diameters of individual trees on each plot).

In making a tally on concentric circular plots, tally the trees on the smallest plot, marking them in some way to avoid tally duplication. Then break the tally and proceed with the trees on the remaining area of the next larger plot, etc. The complete tally of the larger plot sizes at each sample point

TABLE 6.—AREA AND VOLUME (SCRIBNER) PER ACRE BY COVER TYPE AND OPERABILITY CLASS ON 360-ACRE TRACT IN NORTH ARKANSAS

Cover type	Operable portion		Inoperable portion		Total tract	
	Volume per acre	Area	Volume per acre	Area	Volume per acre	Area
	Bd. ft.	*Acres*	*Bd. ft.*	*Acres*	*Bd. ft.*	*Acres*
Pine	5,000	40.0	357	2.8	4,696	42.8
Hardwood	2,408	100.1	243	94.8	1,355	194.9
Redcedar	2,000	27.5	208	43.2	905	70.7
Non forest				51.6		51.6
Totals and averages	2,959	167.6	172	192.4	1,469	360.0

TABLE 7.—COMPARISON OF ACCURACY AND EFFICIENCY OF ALTERNATIVE PLOT SIZES WITH 5.56 PERCENT CRUISE INTENSITY AND RANDOMIZED DISTRIBUTION

Plot size (acre)	Plots	Coefficient of variation per plot	Total survey time	Sampling error	Efficiency
	Number	*Percent*	*Minutes*	*Percent*	*Percent*
0.1	200	168.5	1,154	11.57	100
.2	100	150.7	886	14.65	81
.4	50	139.5	787	19.17	53
.8	25	127.3	590	24.74	43

is obtained by combining the data of the tally segments.

The number of locations to be sampled depends on the accuracy needed. When the cruise load is heavy and cruises of many similar tracts are scheduled, samples taken at about 50 locations in one or two representative tracts will be warranted. For less critical results, a sample of 20 locations should be adequate.

2. Compute the coefficient of variation of volume (or of ΣD^2) for each plot size being tested.

3. Calculate the survey intensity needed for required precision with the smallest plot size.

4. Estimate time required to run surveys of equal intensity for all plot sizes tested.

5. Calculate the efficiency of each survey by the formula given in the footnote to Table 2.

The following example is illustrative. Assume that a sampling error of 10 percent will give the desired precision, and that the coefficient of variation of the 0.1-acre plot is 100 percent. If correction for finite population is disregarded, the number of 0.1-acre plots needed is $\frac{(100)^2}{(10)^2}$ or 100. For an equal survey intensity, there would be required 50 0.2-acre plots, 25 0.25-acre plots, etc.

Now estimate the time needed to run each of these alternative cruises. If the tract is square, travel distance can be equated to $(\sqrt{n}+1)L$. Travel time may then be assumed to be either 1.1 or 0.6 minute per chain, depending on whether the line is run with staff compass and tape or pocket compass and tape (these time values need not be refined). Estimate plot-measurement time for each plot size; refer to Table 5 if a local time study is not available.

Then, if 0.2-acre plots had a coefficient of variation of 90 percent, and if they required a total survey time of 500 minutes as compared to 600 minutes for the 0.1-acre plot survey, the efficiency of the latter would be taken as 100 percent, and the efficiency of the 0.2-acre plot survey would be $\frac{\frac{(100)^2}{100}(600)}{\frac{(90)^2}{50}(500)}$

$= \frac{(100)(6)}{(2)(81)(5)} = 74.1$ percent. Other plot size efficiencies would be similarly compared with that of the 0.1-acre.

Part III. Survey Designs

Parts I and II of this study dealt with the separate effects of plot arrangement and size. In Part III, plot size and arrangement were varied simultaneously and the resultant effects on accuracy and efficiency were compared.

Survey-design study method.—The study area was on the Koen Experimental Forest, a 360-acre tract in a square block 60 chains on a side. Table 6 shows how the total area and volume are distributed by cover-type and operability class. Topography is moderate to steep throughout, and general drainage is east and west.

First the efficiency of various plot sizes was investigated on the assumption that a cruise intensity somewhere in the neighborhood of 5 percent would give satisfactory precision. The procedures leading to Tables 4 and 5 were followed in arriving at Table 7.

Since the 0.1-acre plot appeared to be the more efficient size for cruise intensities in the vicinity of 5 percent, it was decided to use it in comparing a random 6¼-percent cruise with a systematic 6¼-percent cruise arranged in a 1:1 square grid, and to compare both of these with a 10-percent 0.2-acre plot cruise arranged in the conventional 1:5 rectangular grid. The two systematic cruises, then, involved 225 plots spaced 4 chains by 4 chains, and 180 plots spaced 2 chains by 10 chains.

Results.—From the raw volume data of the 100-percent inventory (Table 8), the sampling errors, total survey times, and efficiencies shown in Table 9 were calculated in the same fashion as described in Parts I and II. The 6¼-percent cruise, using 0.1-acre plots arranged in a 1:1 square grid, was far more efficient than either of the other designs.

Nothing may be inferred from this comparison except that a square spacing of 0.1-acre plots is more accurate and efficient than the other systems tested on this particular tract. The comparison bore out what could be expected, but there was some possibility that it might not have. On the whole, it appears that efficiency can be improved by the cruiser who adopts square spacings and uses some judgment in his choice of plot sizes.

TABLE 8.—SAMPLE VOLUMES (SCRIBNER) OF VARIOUS SYSTEMATIC SURVEYS: BASIS FOR CALCULATION OF SAMPLING ERROR

Survey	Net volume of successive non-overlapping samples: 180 fifth-acre plots (systematic 10-percent samples) in 2 x 10 rectangular grid	225 tenth-acre plots (systematic 6¼ percent sample) in 4 x 4 square grid
	Board feet	*Board feet*
1	50,992	35,450
2	48,648	35,540
3	61,361	29,946
4	61,175	38,615
5	56,610	33,472
6	58,451	31,320
7	46,062	34,764
8	48,911	31,634
9	49,309	28,894
10	47,913	30,632
11		33,929
12		28,960
13		31,687
14		34,992
15		36,192
16		33,405
Total	529,432	529,432

TABLE 9.—ACCURACY AND EFFICIENCY OF 3 PLOT ARRANGEMENTS

Plot arrangement	Cruise intensity	Plot size	Plots	Sampling error	Total cruising time	Efficiency
	Percent	*Acres*	*Number*	*Percent*	*Minutes*	*Percent*
Square	6¼	0.1	225	8.17	1,261	100
Rectangular	10	.2	180	10.47	1,125	68
Random	6¼	.1	225	10.87	1,378	52

Summary

Part I. — Square, rectangular, and random arrangements of 16 0.1-acre sample plots were compared for accuracy and efficiency of volume estimates on 12 tracts in north Arkansas. Each tract contained 25.6 acres. The square arrangement included four lines with four plots per line, and the rectangular had two lines with eight plots per line. Considering time requirements and sampling error, the square arrangement was most efficient for 5 of the 12 tracts, the rectangular was most efficient for 4, and the random most efficient for 3.

Part II.—Sampling error and efficiency of four alternative plot-sizes, 0.1-, 0.2-, 0.4-, and 0.8-acre, were compared in 20-percent cruises of eight 40-acre compartments in north Arkansas and Louisiana. The stands represented a wide range in species composition and volume per acre. Sampling error was reduced as plots were made smaller and more numerous, although costs increased. For all compartments containing enough volume to be operable for sawtimber, the increased accuracy of the 0.1-acre plot more than offset the additional cost; in homogeneous and dense even-aged stands, plot sizes even smaller than 0.1-acre might be more efficient, but this was not tested. For cruises of very sparse, scattered, large timber (such as white oak), 0.8-acre plots were more efficient than smaller ones, and still larger plots might have been even more efficient.

Part III.—On a 360-acre tract in north Arkansas, a 6¼-percent cruise using 225 0.1-acre plots arranged in a systematic 4-chain by 4-chain square grid was the most efficient of 3 designs for estimating board-foot volume per acre. The other 2 designs were a random arrangement of the same number of 0.1-acre plots, and a 10-percent cruise using 180 0.2-acre plots arranged in a systematic 2-chain by 10-chain rectangular grid.

❦❦❦

Julius Kahn Appointed to N. Y. College Board of Trustees

Julius Kahn, an attorney practicing in New York City, has been appointed by Governor Harriman to the Board of Trustees of the College of Forestry, State University of New York.

Mr. Kahn is an alumnus of the College of Forestry, class of 1922, and received his law degree from New York University in 1927.

He helped write the code of ethics for the forestry profession, and has been active in the Society of American Foresters on committee assignments having to do with legislation and the licensing of foresters.

Plantation Success in the Harvard Forest as Related to Planting Site and Cleaning, 1907-1947

Stephen H. Spurr[1]
Professor of Silviculture,
University of Michigan, Ann Arbor

DETAILED studies of all forest plantations in the Harvard Forest at Petersham in central Massachusetts provide information on the factors affecting successful establishment of the planted species. Much of the variation in success can be attributed both to the nature of the planting site and the amount of cleaning carried out on volunteer hardwoods.

The present paper is based upon an analysis of all 125 cases of conifer plantings made between 1907 and 1937. Detailed case histories of several of the more important stands have been published by Lutz and Cline,[2] and single-page case histories of many plantations have been compiled by the author.[3]

The 125 softwood plantings in the Harvard Forest range in size from slightly less than one-half acre to 44 acres. They may be subdivided according to whether the planting was done: (1) on open land of old fields or pastures, (2) on semi-open land of old fields or pastures, (3) after the cutting of pioneer hardwoods on old fields, (4) after the cutting of white pine or pine—hardwood mixtures, and (5) after the cutting of transition hardwoods. The early plantings from 1907 through 1917 (58 acres) were largely on open (32 acres) and semi-open (18 acres) land. During the second decade, planting was distributed fairly uniformly between the different conditions and totalled 143 acres. From 1928 through 1937, emphasis was placed on planting following the clearcutting of pine and pine—hardwood types (169 out of a total of 195 acres). Approximately one-half of the total acreage of plantations was set out during this period.

In the vast majority of cases, 2-1 or 2-2 transplant stock has been used. Plantings of seedling stock in general have shown much poorer competitive ability against hardwoods and have been less successful than those set out with transplants.

Considerable effort was made prior to the 1938 hurricane to bring the planted conifers through against the competition of overtopping hardwoods. The cleaning operations were largely carried on with machetes and axes. No chemical treatments are included in the present discussion which is based upon experimental records of the entire forest up to 1950.

Open Land

On all counts, the most successful plantations have been those established on open land. Without exception the planted species have come through to make up the entire new stand. Very little cleaning (also termed weeding or release cutting has been needed. Only 17 of the 30 plantations on open land have been cleaned at all, and these have required an average of only 3½ man-hours of work per acre, largely to prevent the encroachment of hardwoods along the old fence rows or stone walls. All but one of these plantations are on well drained glacial till (Gloucester soil).

Of the various species planted on open land, red pine, Norway spruce, and white spruce have done the best. White pine has shown less growth than red pine and the spruces and, in addition, has been seriously deformed by the white pine weevil under practically all conditions. Spruce — white pine mixtures have proven unsatisfactory because of the weeviling of the pine which has a faster early height growth than the spruce, even though the spruce eventually becomes taller. Spruce—red pine mixtures, on the other hand, have proven among the best, as much of the spruce gradually drops out, giving the red pine a much needed thinning at a time when felling operations are uneconomical. Plantations of ponderosa pine and Scotch pine tend to deteriorate in their middle years, possibly as a result of trees of an unsuitable seed source having been planted.

Semi-Open Lands

Where old fields and pastures with a scattered advance growth of gray birch, pin cherry, aspen, sumac, white pine, and other pioneer species have been planted, the results have been highly successful. The only outright failures have been attempts to establish white spruce on excessively drained sands, a failure due to inability of the species to survive under adverse site conditions rather than to hardwood competition. Scotch pine and red pine on the same site, however, have survived and grown adequately. More than 24 man-hours of weeding over the years were needed in only one plantation, a white pine plantation on a sandy outwash plain where the gray birch was left as an overstory until 12 years after planting. Omitting these five plantations on outwash sands, the remaining 19 plantations of semi-open land with glacial till soils required an average of 2½ cleanings each, taking a total of 11 man-hours per acre. With the exception of occasional areas of imperfectly drained land within the plantations, the planted species came through well. Red pine—spruce mixtures have grown better

[1]Based upon work carried on as a member of the staff of the Harvard Forest, 1940-1950, and derived from a doctoral dissertation submitted to Yale University, 1950.

[2]Lutz, Russell J., and A. C. Cline. Results of the first thirty years of experimentation in silviculture in the Harvard Forest, 1908-1938. Part I. Harvard Forest Bul. 23. 182 pp. 1947.

[3]Spurr, Stephen H. Cases in silvicultural history. Offset. Harvard Forest, Petersham, Mass. 16 pp. + 10 pp. added in 1947. 1944.

than comparable pure red pine or pure spruce. White pine and white spruce have also proven reasonably satisfactory on these sites.

Clearcut Pioneer Hardwood Lands

The third group of softwood plantings consist of cases where the gray birch and other pioneer hardwoods on old fieldls had become so thoroughly established that they had to be clearcut before the area could be planted. These thirteen plantations were put in between 1917 and 1925. In all but two instances, the planted species were brought through successfully with an average of 4.4 cleanings totalling 27 man-hours per acre. Failures were experienced when white spruce was planted on excessively drained sand without cutting the gray birch overstory before planting, and when white spruce was planted on imperfectly drained soil. Red pine required the least amount of cleaning (15 man-hours per acre), while other species were less successfully brought through regardless of the amount of cleaning.

Clearcut White Pine Lands

Where large blocks of trees have been planted on cutover white pine and pine—hardwood areas, success is apparently conditioned by the species planted, site, and amount of cleaning. Red pine has been by far the most successful species. In 9 plantations set out prior to 1936, red pine has come through in all instances requiring an average of only 16 man-hours per acre of cleaning throughout the period. White pine has been less successful. Two early plantations on sandy soils have prospered with only 11 and 14 man-hours of weeding respectively. In six cases on glacial tills, from 40 to 90 percent of the white pine has come through with 18 man-hours of cleaning per acre, but hardwoods still occupy up to half the stand. In another nine cases, white pine has largely failed despite cleanings up to 15 man-hours per acre. It is estimated that 3 to 5 cleanings, totalling 40 man-hours per acre are necessary to bring planted white pine through on cutover old field white pine or pine—hardwood stands. Of the older Norway spruce plantations on these sites, two have come through with 11 and 27 man-hours of cleaning, respectively, but one has failed despite 26 man-hours per acre.

Efforts to improve stocking by supplementary plantings of cutover white pine lands have been unsuccessful and have been abandoned (Lutz and Cline[4]).

Clearcut Transition Hardwood Lands

The final group of plantations consists of 17 stands planted following the clearcutting of transition hardwoods. In these cases, hardwood competition, largely in the form of stump and seedling sprouts, has been excessive. Nevertheless, the red pine plantations have been very largely successful when cleaned repeatedly. The six best red pine plantations have required 4 or 5 cleanings totalling an average of 25 man-hours per acre.

White pine has been largely unsuccessful on cutover hardwood lands. In the most successful plantation, only one-half of the present stand is now white pine despite 31 man-hours of cleaning per acre. The other cases are failures, with cleanings ranging up to 22 man-hours per acre. The above plantations are all on well drained glacial till. One plantation is on very well drained stratified drift. Here, the red pine and the European larch have done well, while the white pine and Norway spruce have failed.

Discussion

From the above analysis of all softwood plantations in the study area, a fairly clear picture emerges of the extent to which planting has changed forest composition. All plantations on open and semi-open land have been successful. Red pine, Norway spruce, and white spruce have been the most satisfactory species on these sites.

On cutover land, planting site is most important. Few, if any, plantations on imperfectly drained land have survived hardwood competition. On excessively drained sites, only red pine, and possibly Scotch pine and European larch have proved capable of consistently taking over the area, with white pine and Norway spruce proving successful only under conditions of less extreme drought and infertility. Most of the plantations on cutover land have been put out on well drained uplands (Gloucester, Brookfield, and Charlton soils). Cleaning is necessary in all instances. Red pine is the most successful species, requiring 15-16 man-hours of cleaning per acre on cutover pioneer hardwood, white pine, and pine—hardwood lands, and around 25 man-hours per acre on cutover transition hardwood lands. Also successful are the exotic larches. Because European larch is almost invariably killed by porcupine girdling, however, only the Japanese larch, Dahurian larch, and possibly Dunkeld larch can be brought through to maturity. White pine can be brought through only by intensive cleaning. On cutover lands of all types on glacial till, probably 40 man-hours per acre distributed among 4 to 5 operations at intervals of several years are necessary to bring this species through. Less definitive information is available concerning Norway spruce and white spruce. Neither is successful on imperfectly drained soils or on excessively drained sands. On well drained glacial till, both form good plantations. Their slowness in height growth during early years, however, make many cleanings necessary when they are planted on cutover land. Apparently these species will require more cleaning than red pine but less than white pine.

In summary, red pine seems to be by far the best plantation species in central New England, forming successful plantations with a minimum of cultural work on a wide variety of sites. If mixed with Norway or white spruce, thinning operations can be delayed because of the natural thinning resulting from the gradual suppression of the weaker spruces. Both Norway and white spruce will also

[4]Op. cit.

form satisfactory plantations provided the hardwood competition is not too severe. White pine is less satisfactory in that its survival depends upon repeated heavy cleanings, and the quality of the resulting stand is greatly lowered by heavy weevil damage. The Asiatic larches are promising but insufficiently tested. None of the other species planted between 1907 and 1937 can be recommended in the light of present-day knowledge. Modern chemical cleaning techniques may well improve the prospects of success when conifers are planted on natural hardwood soils.

Georgia's New Dewinger

S. P. Darby
Chief of reforestation,
Georgia Forestry Commission,
Macon

ANNUALLY the Georgia Forestry Commission uses from 15,000 to 20,000 pounds of pine seed in its four forest tree nurseries. In 1954 it was first realized that equipment used for seed extraction and cleaning damaged the seed. Tests were therefore conducted to determine the effect of equipment on cleaned seed and it was found that the dewinger (Fig. 1) caused from 12 to 15 percent reduction in germination (*4*). Similar injury was also reported by Umland of T.V.A. (*2*), though his test showed the amount of injury to be slightly higher. This reduction in seed germination was attributed to repeated jarring of the seed as it passed through the machine, causing injury to the embryo in some unknown manner. No outward signs of injury such as cracked or scarified seed coats were observed, nor were any mashed seed found which might have internal damage.

Faced with the problem that a loss of several thousand dollars was being incurred annually due to dewinger injury, a study was initiated by the Georgia Forestry Commission in cooperation with the Southeastern Forest Experiment Station[1] to locate or develop a new machine or modify the existing dewinger so as to eliminate or minimize this undesirable effect. The machine described below was found to dewing seed with a minimum of injury.

[1]Forest Service, U. S. Dept. Agric., Asheville, N. C.

Description

The Crippen Model EP-26 polisher shown in Figure 2, was developed as a popcorn polisher. It was designed to remove "bee wings, light chaff, and dirt from shelled popcorn, without damaging the cleaned product" (*1*). Since dewinging pine seed is a similar process, several pounds of uncleaned slash seed were sent to the Crippen Manufacturing Company of Alma, Michigan, for testing purposes. Germination tests (*3*) indicated that seed passed once through the machine suffered no injury. Seed that went through the polisher two or more times showed a slight reduction in germination. In view of the fact that seed passed through the polisher one time were apparently uninjured yet dewinged ade-

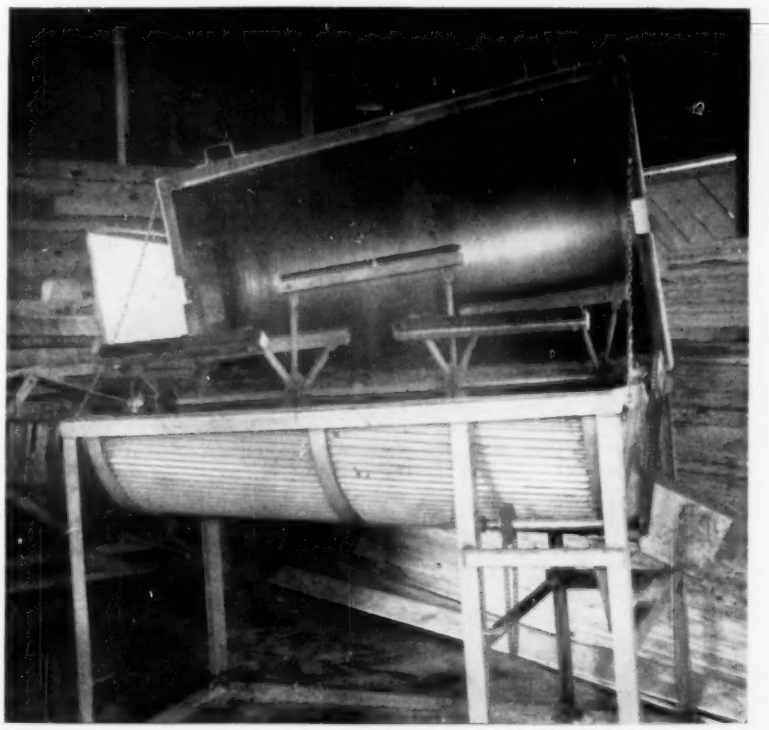

FIG. 1.—Standard Forest Service type dewinger.

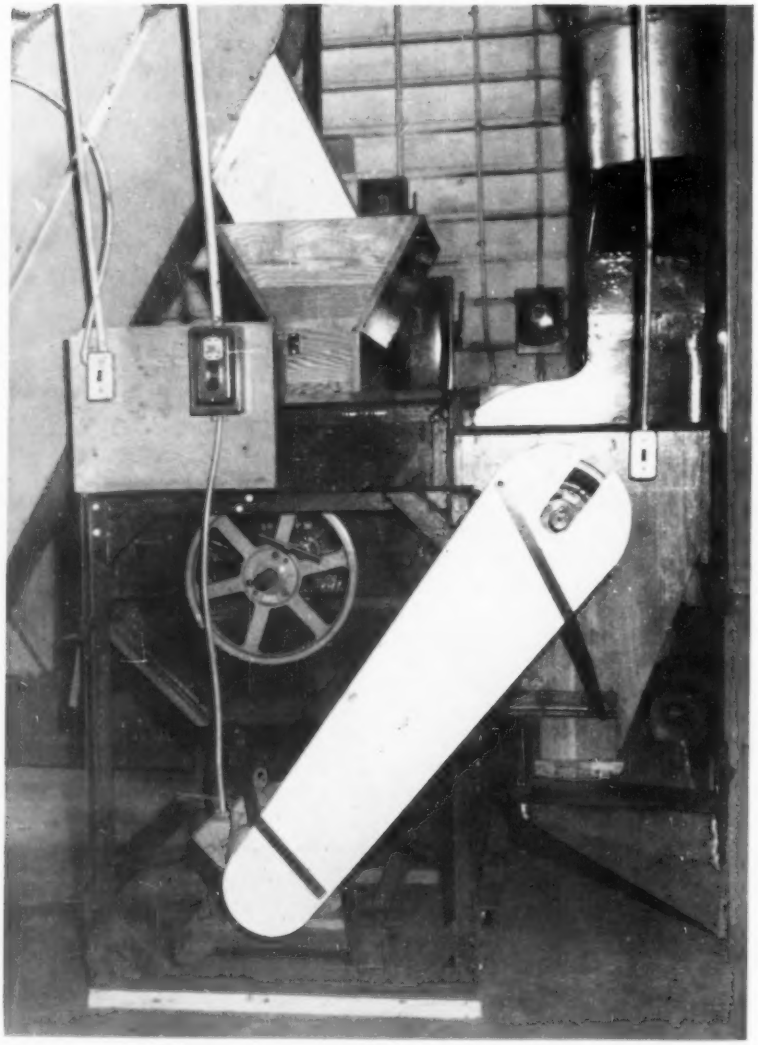

FIG. 2.—Crippen Model EP-26 Polisher.

quately, the machine was adopted for use.

The Crippen polisher is similar in design to the dewinger shown in Figure 1 in that its dewinging action is accomplished by revolving brushes. It differs greatly in that seed cannot remain in the machine for an indefinite period. The revolving brush carries the seed around the inner surface of a special wear-resisting rubber cylinder. This rubs the seed gently between the brush fibers and the special rubber surface. The revolving brushes are mounted on a cylindrical form and are adjustable for pressure or wear by the use of only one adjustment screw. From the brush unit the seed enters an aspirating chamber for removal of material taken off by the polishing action. Details of construction are shown in Figure 3.

Discussion

Table 1 shows germination percentages on slash and loblolly pine seed collected during 1954. Table 2 presents similar information on seed collected during 1955. The lots of seed shown in Table 1 and 2 varied in size from 100 to 2,000 pounds and were representative for the two seasons. During 1954, 27,933 pounds of seed were dewinged by the Forest Service dewinger. At the completion of the 1955 season 34,000 pounds of slash, loblolly, and eastern white pine seed had been dewinged by the Crippen polisher.

As operated by the Georgia Forestry Commission, seed dewinged by the Crippen polisher is superior to seed cleaned by the Forest Service dewinger now commonly employed by many seed extractories. The germination of seed cleaned by the Crippen machine in 1955 was 25 percent higher for slash (*Pinus elliottii* Engelm.) and 27 percent higher for loblolly (*P. taeda* L.) than seed cleaned the previous year by the Forest Service type dewinger. While the action of the new polisher may not account for the entire increase in germination, a large percent of the increase can

TABLE 1.—GERMINATION DATA FOR PINE SEED DEWINGED DURING 1954 BY OLD TYPE DEWINGER

Slash		Loblolly	
Lot number	Germination	Lot number	Germination
	Percent		*Percent*
G-4-1	47	G-4-3	62
G-4-1B	65	G-4-3X	65
G-4-3	62	G 43 Y	58
G-4-5	55	G 44 XY	71
G-4-5B	62	G 46 XY	53
G-4-5C	60	G 45	40
G-4-8	54	G 40 XY	44
G-4-8B	62	G 40	48
Average	58.3	Average	55.1

TABLE 2.—GERMINATION DATA FOR PINE SEED DEWINGED DURING 1955 BY CRIPPEN MODEL EP-26 POLISHER

Slash		Loblolly	
Lot number	Germination	Lot number	Germination
	Percent		*Percent*
G 5-2 A	82	G 5-4	86
G 5-2 B	81	G 5-6	74
G 5-3 A	78	G 5-6 A	80
G 5-5 A	85	G 5-6 B	83
G 5-8 A	87	G 5-0	82
G 5-8 B	83	G 5-0 A	85
G 5-1 B	85		
Average	83	Average	82

be attributed to it. To determine the exact percent increase would involve a comparison of percent full seed for the two years under consideration. This is necessary because a large three-screen fanning mill[2] was installed for the 1955 season replacing a small two-screen cleaner[3] used during 1954.

Cracking tests revealed that 1955 slash seed contained 5 percent hollow or immature seed after cleaning, as compared to 7 percent for 1954 slash seed. Loblolly seed (1955 season) showed 12 percent blind seed as compared to 21 percent for the 1954 lots. A comparison of the average germination percentages presented in Tables 1 and 2, and average percent filling as shown above, reveals that the Crippen polisher did account for a large portion of the increase in germination experienced during 1955.

Conclusion

The writer does not mean to infer that the polisher described above accounts for the entire increase in germination 1955 seed shows over seed collected and extracted during the 1954 season. More exhaustive studies would be necessary to compare such variables as maturity of cones at time of collection and effects of season on germination. Assuming the polisher under consideration accounted for a fifteen percent increase in germination and that the average cost of slash or loblolly seed is $3.25 per pound, would give a saving during the 1955 season of $16,500 in seed cost alone. In addition to this saving, future savings will be experienced in cold storage and transportation of seed. Nursery sowing rates will also be reduced.

The Crippen No. EP-26 polisher has been found to be most satisfactory for dewinging slash, loblolly, and eastern white pine seed and the investment of $1,068 necessary to procure the polisher has been justified many times. Other species of seed requiring dewinging have not been tested adequately to make recommendations. However, it is assumed the machine would work equally well if properly adjusted.

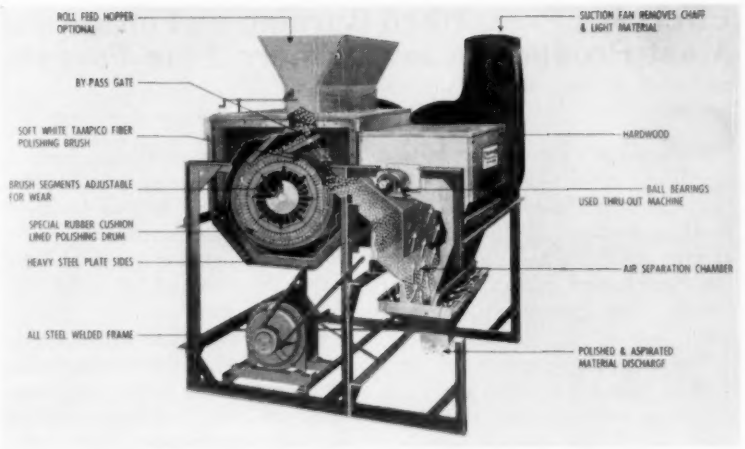
ROLL FEED HOPPER OPTIONAL
SUCTION FAN REMOVES CHAFF & LIGHT MATERIAL
BY-PASS GATE
SOFT WHITE TAMPICO FIBER POLISHING BRUSH
HARDWOOD
BRUSH SEGMENTS ADJUSTABLE FOR WEAR
BALL BEARINGS USED THRU-OUT MACHINE
SPECIAL RUBBER CUSHION LINED POLISHING DRUM
HEAVY STEEL PLATE SIDES
AIR SEPARATION CHAMBER
ALL STEEL WELDED FRAME
POLISHED & ASPIRATED MATERIAL DISCHARGE

FIG. 3.—Model EP-26 Crippen Cleaner showing construction details.

Literature Cited

1. CRIPPEN MFG. CO. Equipment catalog No. 51, Alma, Mich.
2. UMLAND, C. B. 1955. Letter to southern nurserymen.
3. UNPUBLISHED DATA. 1955. Seed germination reports. Region 8 seed testing laboratory operated by Georgia Forestry Commission in cooperation with U. S. Forest Service, Macon, Ga.
4. UNPUBLISHED DATA. 1955. Annual report. Region 8 seed testing laboratory operated by Georgia Forestry Commission in cooperation with U. S. Forest Service, Macon, Ga.

[2]Clipper No. BD 47.
[3]Clipper No. 27.

Coming Events

New England Section Meeting

The New England Section will hold its summer meeting on September 6 and 7 at Orono, Maine.

Allegheny Section Meeting

The Allegheny Section of the S.A.F. will hold its meeting in Ocean City, Md., September 6-7, 1956.

Wisconsin-Michigan Section

The Wisconsin-Michigan Section will meet September 14-15 at Shawano, Wisc.

New York Section

The summer meeting of the New York Section will be held September 13 and 14 at Whitney Park, Sabbatis, N. Y.

Canadian Forestry Association

The Canadian Forestry Association will hold a National Forestry Conference in Winnipeg, Ontario, Canada, September 17-19, 1956.

Lignin Round Table

The Third Lignin Round Table will be held in Appleton, Wis., September 24, 25, and 26. The theme will be "The Biochemistry of Lignin."

Society of American Foresters Annual Meeting

Annual meeting of the Society of American Foresters will be held in Memphis, Tenn. at the Peabody Hotel, October 14-17, 1956.

Effects of Prescribed Burning on Forage and Mast Production in Southern Pine Forests[1]

Daniel W. Lay
Texas Game and Fish Commission,
Buna, Texas

PRESCRIBED BURNING under certain conditions in the southern pine forests serves in the control of hardwood understory, the preparation of pine seedbeds, the reduction of fire hazard, and in the control of brown spot disease on longleaf pine.

The primary purpose of prescribed burning in pine-hardwood types as recommended by Chapman (*3*), Little (*6*), Silker (*8*), and other foresters is to maintain a subclimax association in which pine can dominate. Hardwoods are the climax type on most southern sites (Wells, *11*) but there is a stronger market demand for pines.

One of the earliest advocates of prescribed burning for wildlife was Stoddard (*10*) who found that fire was essential to quail management in the southeast. Uncontrolled fires on moose range in Alaska (*9*) and on Isle Royale (*1*) have had very beneficial effects on the browse supply and on the herds. Leopold (*5*) noted the importance of subclimax stages of succession for deer and suggested that prescribed burning where applicable is the cheapest tool for increasing the deer carrying capacity of some ranges. The present study was designed to evaluate the effects on wildlife habitat of burning in southeast Texas.

Study Area and Methods

The Texas Forest Service in 1949 started a study to determine how to use fire for the control of undesirable hardwoods in pine-hardwood stands and slash pine plantations. Spring, late summer, and winter burns were used at two and three-year intervals and each treatment was replicated three times on three-acre plots.

The original understory on these plots, as reported by Silker (*8*), varied for three stand condition classes from 13,000 to 38,000 hardwood stems under one inch in diameter per acre and from 500 to 1,000 stems one to five inches in diameter. The average height of the understory was 9.2 to 11.7 feet before the fires and 1.8 to 5.8 after the second fire.

Burning was done with backfires or strip-headfires when the moisture content of upper and lower fuels, relative humidity, wind, and air temperature were favorable.

Wildlife evaluations were made of these plots in 1953-1955, with primary emphasis on deer. No deer or livestock were present and there had been no fire for at least 20 years so the flora was exceptionally complete and undisturbed.

Two methods were used to measure the production of browse by species and herbs and grasses-sedges by groups. Plots 2 by 48 feet were clipped to determine the weight of forage. The plot size was such that grams on the plot were equal to pounds per acre, as described by Campbell and Cassady (*2*). Current-season growth not over 3/16 inch in diameter and not over 6 feet high was clipped and weighed immediately. Clipping was done after July 1 each year, measurements of monthly growth on 60 plants of three species having shown that 89.4 percent of the season's linear growth is completed by that time. Moisture content was determined on a large number of species, with plans to convert all data to air-dry basis; but tests showed no significant effects of fire on moisture content so the original green weights were used.

The second method was line-point intercept plots as described by Parker (*7*) and Dasmann (*4*), in which a 50-foot tape was stretched and a ¾ inch circle checked every six inches for browse canopy up to 6 feet high and for grass crown and herb stem.

Weight plots were used in 1953 and 1954 and intercept plots were used in 1955. A comparison of 27 plots worked with both methods showed no significant difference for 10 common woody species. The clipping method is slower but more accurate in comparing woody and herbaceous forage.

To evaluate the effects of burning on mast production, a series of 69 1/10 acre circular plots was checked in October 1953 and June 1954 to determine the number of plants of mast-bearing size and the number of plants with mast. Species which do not produce mast until they reach a size too large to be affected by fire, such as pines and oaks, were not included. The results are a measure of fire effects on understory mast production.

Effects on Forage Production

Production on burned and unburned plots was compared by the number of growing seasons since the last fire—one, two, or three. Results for woody, herbaceous and total forage are reported in Tables 1 and 2. Browse forage was reduced for two years, herbaceous forage was increased for at least

TABLE 1.—SUMMARY OF FORAGE PRODUCTION ON BURNED AND UNBURNED PLOTS FOR 1953, 1954, AND 1955[1] (Green weights in pounds per acre)

Type of Forage	Method of measure	First season after last fire		Second season after last fire		Third season after last fire	
		Unburned	*Burned*	*Unburned*	*Burned*	*Unburned*	*Burned*
Woody	Intercept	82.1	36.1	82.1	66.3	82.6	77.3
	Weight	675	524	848	743	794	606
Herbaceous	Intercept	2.2	6.7	2.2	6.4	1.9	10.7
	Weight	100	476	168	379	143	244
Total forage weight		775	1000	1016	1122	936	850

[1]The number of plots and the number of burns represented by each pair of figures are shown in Table 2. Differences in unburned plots each season are due to rotation of burns and check plots.

[1]A contribution of Federal Aid in Wildlife Project, Texas W-63-R.

TABLE 2.—SUMMARY OF PERCENTAGE CHANGES IN FORAGE PRODUCTION AFTER BURNING 1953, 1954 AND 1955

Type of Forage	Method of measure	First season after last fire			Second season after last fire			Third season after last fire		
		No. plots	*No. burns*	*Percent change*	*No. plots*	*No. burns*	*Percent change*	*No. plots*	*No. burns*	*Percent change*
Woody	Intercept	39	3	—56**	39	2-3	—19**	30	2	—6
	Weight	54	2	—22	15	2	—12	21	1	—24
Herbaceous	Intercept	39	3	205*	39	2-3	146*	30	2	463**
	Weight	54	2	376	15	2	126	21	1	71
Total forage	weight	54	2	20	15	2	10	21	1	—9

*Exceeds the 5 percent level of probability.
**Exceeds the 1 percent level of probability.

three years, and there was no great change in total production.

The summaries of data from intercept plots showed statistically significant differences in five of six comparisons and the weight plots showed none. This was not unexpected because the intercept measurements range to 100 and the weights range to 4300. The intercept method is inadequate for combining woody and herbaceous measurements. The total is biased in favor of the woody part because the canopy is measured in one case and the stem or crown is measured in the other.

Species reaction to fire was more pronounced. Table 3 gives the records for 13 species, herbs, and grasses-sedges. The data for some of these species and for about 75 others not reported were inconclusive. Some may not be affected by fire, others were too rare for the limited number of plots.

The following species were reduced: yaupon (*Ilex vomitoria*), holly (*Ilex opaca*), blackgum (*Nyssa sylvatica*), wax myrtle (*Myrica cerifera*), dogwood (*Cornus florida*), and tree huckleberry (*Vaccinium arboreum*).

Burning increased French mulberry (*Callicarpa americana*), viburnum (*Viburnum molle*), greenbriar (*Smilax glauca*), sweetleaf (*Symplocos tinctoria*), sweetgum (*Liquidambar styraciflua*), blackberry (*Rubus* spp.), herbs, and grasses-sedges.

Since the burning did not materially affect total forage production, evaluation for wildlife must be based on changes in species composition. This requires recognition of important food plants for each wildlife species. A two-year study of food habits of penned white tailed deer on the Siecke State Forest was the basis for palatability ratings shown in Table 3. Table 4 reflects the proportions of browse species that are desirable, intermediate, and undesirable for deer. About one third of the browse is desirable deer forage.

Among the common species, yaupon was the only desirable deer food reduced by fire. Common and

TABLE 3.—PERCENTAGE CHANGES IN FORAGE PRODUCTION BY SPECIES AFTER BURNING (See Table 2 for number of plots and number of burns)

Species and palatability for deer	Methods of measure	First season after last burns	Second season after last burns	Third season[1] after last burns	Average all burns[1]
Yaupon Desirable	Intercept	—90**	—82**	—70**	—83
	Weight	—68**	—35	—4	—47
Holly Intermediate	Intercept	—97**	—94**	—90**	—94
	Weight	—90**	—93**	—94**	—92
Fr. mulberry Desirable	Intercept	—48	—67	36	18
	Weight	20	179	—5	30
Blackgum Intermediate	Intercept	—70	—91*	—93*	—84
	Weight	—38	—100*	—60	—61
Yel. jessamine Desirable	Intercept	—61	—4	132	16
	Weight	23	—100	—57**	—15
Viburnum Desirable	Intercept	—30	0	—100	—39
	Weight	515	280**	—100	298
Smilax glauca Intermediate	Intercept	211	1610	500	800
	Weight	118	981*	2	208
Sweetleaf Intermediate	Intercept	—25	146	300*	100
	Weight	64	97	—5	62
Wax myrtle Undesirable	Intercept	—38	—10	30	—11
	Weight	—7	—52	—75	—36
Sweetgum Intermediate	Intercept	4	96	39	46
	Weight	89	—85	90	88
Blackberry Intermediate	Intercept	100	231	263	186
	Weight	—10	308	130	68
Dogwood Undesirable	Intercept	—63	—68	50	—60
	Weight	—77	—98	—92	—82
Tree hucklb'ry Undesirable	Intercept	—85	—74	—75	—78
	Weight	—85	—35	—90	—82
Herbs Desirable	Intercept	316**	258*	146	267
	Weight	681	236**	146	411
Grasses-Sedges Undesirable	Intercept	125	150	750**	250
	Weight	194	32	15	103

*Exceeds the 5 percent level of probability.
**Exceeds the 1 percent level of probability.
[1]Not tested statistically.

TABLE 4.—EFFECTS OF BURNING ON BROWSE BY THREE CATEGORIES OF PALATABILITY FOR DEER IN GREEN WEIGHTS PER ACRE AT SIECKE STATE FOREST OCTOBER 1953.

Category	21 unburned plots	48 burned plots
Desirable	237 pounds	205 pounds
Intermediate	273 pounds	212 pounds
Undesirable	156 pounds	145 pounds
Totals	666 pounds	562 pounds

desirable deer foods increased by fire were French mulberry, viburnum, and herbs. On this range the reduction in yaupon appears to be offset by the increases of other species. Although yaupon is an important winter food, there are several others available. It is possible that elsewhere yaupon is so important to winter carrying capacity that fire damage to it would offset any gains.

Another factor in evaluating fire effects on deer range is improvement of forage quality. Unpublished work has shown that burning raised protein levels through the second winter and phosphorus levels until the first winter. Spring burning caused more improvement in forage quality than fall or winter burning.

Large-scale burning should consider the pattern or distribution of the burns if maximum wildlife is desired. In general, the pattern that produces the most diversity of understory habitat will be most beneficial to wildlife.

Considering all of the data, there seems little chance for much damage to deer range by fire. The possible benefits increase as the understory grows out of reach of deer. The above study was made where the understory averaged 9 to 12 feet high before burning. If succession had been more advanced and the average height had been 20 feet, prescribed burning would have been more beneficial for deer but possibly not as beneficial in hardwood reduction.

Effects on Mast Production

Understory mast production is seriously reduced by fire. The 69 plots checked in October 1953, showed that burning (with no segregation by stand class, burning season, interval, or number of burns) reduced the number of plants per acre of fruiting size 62 percent from 208 to 68 and the number of plants per acre with fruit 72 percent, from 50 to 14.

The same plots in June 1954, with a few new species which could not be checked for mast in October, showed a reduction by fire of 72 percent in the number of plants with fruit. All of these figures are significant at the 1 percent level. There was no significant difference in the percentage of plants with fruit.

The effects on the number of plants per acre with fruit by species was to reduce yaupon, holly, and sweetleaf 95 percent (each significant at .01) and viburnum 84 percent (sig. at .05). The number of dogwood plants of fruiting size was unchanged but the percentage of those with fruit increased 83.3 percent (sig. at .01) after burning. French mulberry plants and plants with fruit seemed to be increased; tree huckleberry appeared to be decreased.

Conclusions

The value of prescribed burning as a tool for improving forest habitat for wildlife varies with the species and the locality. For deer the benefits increase as the understory succession moves away from optimum conditions of height and density. Care must be taken against the possibility of damaging one key species where other species and improvements in condition and quality cannot make up the loss. This possibility seems to be rare and in general fire is unlikely to damage deer range.

Squirrels, turkeys, deer and quail suffer some loss of food in the general reduction of understory mast. The gains in herbs and improvement of understory condition definitely favor quail and probably favor turkeys. Burning may result in a net loss for squirrels, depending upon the importance of understory mast.

Summary

1. Prescribed burning, where the understory averaged 9 to 12 feet high, reduced browse for two years, and increased herbaceous forage for at least three years, but caused little change in total forage production.

2. The burning decreased yaupon, holly, blackgum, dogwood, wax myrtle, and tree huckleberry. It increased French mulberry, viburnum, Smilax, sweetleaf, blackberry, sweetgum, herbs, and grasses-sedges. Of the four desirable deer foods in this group—yaupon, French mulberry, viburnum, and herbs—fire decreased one and increased three.

3. Burning reduced the number of understory plants of fruiting size 62 to 72 percent and the number of plants with fruit 68 to 72 percent. Dogwood fruiting was increased 83 percent.

4. The benefits to be gained for a wildlife species through prescribed burning increase as the succession progresses away from the conditions desired for that species.

5. For deer in East Texas there appears to be little possibility of serious damage to the habitat from burning. Properly used fire can increase the quantity and quality of deer forage.

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Upland Hardwoods in South Arkansas Pine Stands—Aerial or Underground Fifth Column?

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A RECENT study in southern Arkansas indicates that sprouting from old rootstocks, and not new seeding from distant untreated areas, accounts for nearly all the hardwood brush that often is present under pine stands in which the seed-bearing hardwoods have been cut or deadened.

The study was installed in 1951, on the Crossett Experimental Forest.[2] The five-acre area chosen for the test had a pine overstory varying from 3,000 to 8,000 board feet per acre (International rule, ¼-inch kerf) and a dense hardwood understory of the more prevalent species, chiefly southern red oak (*Quercus falcata* Michx.), forked leaf white oak (*Q. alba* L.), post oak (*Q. stellata* Wangenh.), water oak (*Q. nigra* L.), sweetgum (*Liquidambar styraciflua* L.), blackgum (*Nyssa sylvatica* Marsh.), elm (*Ulmus fulva* Michx.), red maple (*Acer rubrum* L.), hickory (*Carya tomentosa* Nutt.), dogwood (*Cornus florida* L.), and persimmon (*Diospyros virginiana* L.). This understory was mainly from the sprouting of the stumps and root systems of a heavy stand of larger hardwoods, most of which had been cut or deadened between 1938 and 1948. Chemicals had not been used to control sprouting.

Early in 1951, all remaining hardwoods larger than 3.5 inches in d.b.h. were girdled—not only on the 40-acre compartment in which the study area was located, but also on the 4 adjoining 40-acre compartments. When this experimental work was finished, few if any hardwoods of seed-bearing size could be found within about 800 feet of the study area. Such an isolation belt was desired so as to study possible reinvasion by hardwood seed carried by wind, gravity, water, or animals. Wind or gravity dispersal of the heavy seeds of oaks and hickories is known to be slight, and even sweetgum seed does not blow far from the parent tree.[3] In hilly country or very open stands it is possible that seed like elm and red maple would be carried long distances by updrafts or very strong winds. This is unlikely in level country or in fairly heavy stands of timber.

After the larger hardwoods had been killed, four ¼-acre plots were established at random in a portion of the compartment that had 3,000 to 5,000 small hardwoods per acre. These hardwoods were treated with Ammate in May 1951, shortly after the new leaves were fully grown. Those 1.0 to 3.5 inches in diameter were cut down, and a spoonful of Ammate was placed on the V-notch stump. The foliage of all hard-

[3]Guttenberg, S. Sweetgum seed is overrated flier. Jour. Forestry 50:844, 1952.

FIG. 1.—Sprouting of old hardwood rootstocks causes much of the so-called hardwood invasion. Some of the rootstocks are 50 or more years old.

[1]Forest Service, U. S. Dept. Agric.

[2]The Crossett Experimental Forest is maintained by the Southern Forest Experiment Station in cooperation with The Crossett Company.

FIG. 2.—One of the sample plots in May 1955. The small hardwoods in the background are off the plot but are similar to those removed from the plot; practically all of them are stump sprouts from trees cut between 1938 and 1948. The pine seedlings on the plot came in after the study began.

TABLE 1.—PER-ACRE STOCKING OF SMALL HARDWOOD STEMS

Species	In 1951, prior to treatment		In 1955, after treatment	
	No.	*Perc.*	*No.*	*Perc.*
Oak	878	24	10	4
Hickory	105	3	8	3
Sweetgum	665	19	2	1
Blackgum	1,192	33	20	8
Dogwood	485	14	0	0
Other hardwoods	258	7	210[1]	84
Total	3,583	100	250	100

[1]In 1955 the 210 hardwoods of other species included 65 persimmon, 48 red maple, 27 sassafras, 58 elm, and 12 miscellaneous.

woods under 1 inch in diameter was sprayed with a water solution containing 2 pounds of 80-percent Ammate per gallon. In 1952 all green stems were again sprayed with the same solution.

In May 1953 the plots appeared free of hardwoods when viewed from the outside. Close examination, howevtr, revealed several hundred small shoots per acre. When these were dug up, all proved to be attached to old rootstocks or to a root system whose diameter below ground was larger than the diameter of the stem above ground (Fig. 1). There was little question that all were sprouts rather than new seedlings.

The plots were reexamined in June 1954, at which time a tally was made of the live hardwood stems present. To eliminate the possibility of recording sprouts from the root systems of stems outside the plots, the tally was limited to the central one-tenth acre of each quarter-acre plot. Three hundred and eight live stems (770 per acre) were found and dug out. Only one of these, a sassafras, was identified as coming from new seeding.

In May 1955, the fourth year after the original treatment, a total of 100 live stems were found on the 4 tenth-acre plots—a number equal to 250 per acre (Fig. 2). Again all the stems and as much of the root systems as possible were dug up. All stems except one were from pieces of old root systems that had survived the chemical treatment and the digging of 1953 and 1954. The exception was a red maple with a very small root system. It was either 5 or 6 years old and had seeded in before the study began.

Table 1 compares the number and species of hardwoods found in 1951 and 1955. The treatments have eliminated or greatly reduced the oak, sweetgum, and dogwood stems; but elm, persimmon, red maple, and sassafras have shown great ability to sprout from a small piece of live root. Even chemicals have not completely deadened the root systems.

Conclusions

This study indicates that hardwoods are usually old residents in shortleaf and loblolly pine forests, and not sudden invaders. The only way to reduce them to reasonable numbers is to choose control methods that kill most of the rootstocks as well as the above-ground stems.

When hardwoods of seedbearing size are to be left in pine stands, whether for timber growth or to produce game food, they should be grouped rather than scattered on every acre. This would minimize the rate of spread from either seed or roots. The groups should, if possible, be near branch heads, along small streams, or on other sites where hardwoods grow well enough to produce good timber and game food.

Financial Maturity—What's It Good For?

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OVER the past few decades the planned production of forest crops has been a rapidly expanding business on the American economic scene. Much of the progress can be attributed to foresters' efforts to understand the business considerations underlying timber management. Foremost in this respect has been an increasing realization among foresters that the timber growing enterprises can not be looked upon as a separate entity, but must be considered as a part of the forest owner's total business or household. Modern forest management planning is giving increasing consideration to the interests of the business as a whole and the functions woodlands serve in the business. This progress in forest management planning is particularly evident in the case of industrial forestry.

For forest crop production to make its maximum contribution to individual firms as well as to the national economy, forest economists must continue to develop sound and practicable methods for appraising business alternatives that will hold foresters accountable for the decisions they make. The development of the financial maturity concept and its application has been one of the principal efforts in this direction.

The financial maturity concept is not new, but was clearly defined in forestry literature as early as 1913 by W. W. Ashe:

> Single trees of yellow poplar can be considered mature financially when their annual rate of increase in value becomes equal to the current rate of interest on money. If timber is held after the rate of increase in value falls below the interest rate, there is a loss, since if the timber had been sold, the proceeds could have been invested as loans at the current rate on money. (1, p. 36)

While this principle has been more or less generally understood and applied by American foresters insofar as practice and knowledge permitted, it did not receive a great deal of attention in American forestry literature prior to 1950. In 1942 S. O. Heiberg used it in the preparation of economic increment charts for eastern white pine (*7*), and in the same year the Lake States regional office of the Forest Service prepared tree value increase tables for sugar maple, yellow birch and basswood (*11*).

Beginning in 1951, the preparation of value increment tables for application of the financial maturity concept greatly accelerated. Between 1951 and 1953 the Southern Forest Experiment Station published tree value increment tables for loblolly and shortleaf pine for the Crossett, Ark. area (*6*), for bottomland red oaks and sweetgum in the Mississippi River Delta and other southern river bottoms (*5*), and for oaks and yellow-poplar in the uplands surrounding Birmingham, Ala. (*2*). The Northeastern Forest Experiment Station published similar information for yellow-poplar in West Virginia in 1952 (*9*). In 1954 Bertram Husch prepared value growth percent data for black cherry growing in northwestern Pennsylvania (*10*), and in 1955 S. O. Heiberg and Philip G. Haddock published a value increment chart for young Douglas-fir in Lee Forest, Maltby, Wash. (*8*). Also in 1955, the Southeastern Forest Experiment Station published value increment tables for twelve Appalachian hardwoods (*3*).

The foregoing citations are the principal published works concerned with the application of the financial maturity concept to particular species and locations. Although all these references are concerned with the application of the financial maturity concept to the practical problem of choosing between trees to leave and those to cut, they vary considerably in the bases used for defining individual tree values and value increment as well as in details regarding the practical use of the concept. In this paper the writers bring together the essential ideas underlying the application of the financial maturity concept and attempt to present them in a manner and language that the busy practical forester can readily grasp. Although the concept is applicable to both stands and individual trees this article is concerned primarily with the individual tree application.

Meaning and Objectives

The meaning of financial maturity is most easily understood by considering the case of the individual tree. The financial maturity concept looks upon the individual tree as a negotiable bond paying a certain rate of interest which is its rate of value increase. It suggests, that if the rate of value increase is in excess of the rate the funds from such a bond (or tree) would yield elsewhere, the bond (or tree) is the most profitable use for such funds. Where the yield rate is less, it suggests selling the bond (or tree) and reinvesting the funds in a more renumerative alternative.

Thus, the financial maturity concept makes it possible to better understand and evaluate one of the important business aspects of timber growing. It accomplishes this by increasing the accuracy of judgment in selecting the trees the forester should leave for future income and those he ought to harvest to satisfy current income or wood requirements.

The guiding rate for the financial maturity decision must be determined by the forest owner. As suggested above, the owner may decide upon a guiding rate accord-

ing to the alternative opportunities for the use of his capital within or outside his forest business. Or he may derive the rate from the cutting budget for his woodland enterprise, in which case it equals roughly the growth rate of the most productive and promising trees that must be harvested to meet the budget. A rate so determined is referred to as an alternative rate and should be adjusted for differences in risk as well as for taxation of earnings.

This is the basic story, but not the whole story. In applying the financial maturity concept, values other than the value increase of the tree itself are involved and should be taken into account. It is, for example, necessary to consider the influence of leaving the tree on: (1) the value increment of other trees; (2) maintenance of site quality, and (3) income from future rotations. These are very difficult, if not practically impossible, to appraise objectively and concretely. Thus, it follows that the personal judgment of the tree marker must still be introduced to determine how these considerations would modify the appraisal of financial maturity based on the value increase of the tree alone.

Appraisal of the intrinsic value increment of a tree provides only the core for the financial maturity decision. Its major utility lies in the fact that it accounts for the largest part of the income from growing timber. Furthermore, quantifying actual value increase in the form of a rate simplifies the decision which ultimately must be made: to harvest or leave the tree in question. It also provides an explicit means for making the forester accountable for his marking decisions to the forest owner. And the matter of accountability is a primary principle of good business management.

Means of Application

It is impractical to take increment borings to determine the value growth rate of every tree when applying the financial maturity guide or any other guide in selecting trees for harvest. Reference can be had to prepared tables which classify trees by size, quality, and vigor and give average values and rates of value increase for each classification. Such tables have been called economic increment charts, value increment charts, or financial maturity guide tables (*4*). These tables, in most cases, are one of the principal parts of the published works cited above. Given such tables and an alternative interest rate as a guide, it is then a simple matter to determine the size, quality, and vigor criteria which will identify trees typically growing below the guiding rate.

The use of the financial maturity guide requires information on tree values in relation to size, grade, and species and the corresponding average growth rates by vigor classes. The simplest basis for tree evaluation, and the only basis which is defensible, is conversion surplus. Conversion surplus is the residual value of the tree based on the price of the end product sold by the forest owner less the direct (variable) costs incurred in converting the tree into its end product. This product could be stumpage, logs at roadside, logs at mill, lumber f.o.b. mill, or any other forest product. Fixed costs incurred by the tree owner for administration and supervision, timber processing, timber management, or land taxes need not be prorated to individual trees since such costs have to be paid whether a particular tree is cut or not. Cutting one tree as compared to another does not change these costs. Conversion surplus, then, is a measure of how much a tree can contribute to payment of fixed costs and profits. It applies to the harvested trees as well as to those left for continued growth.

For the owner who sells stumpage, conversion surplus is practically equivalent to stumpage price. His principal direct costs are those involved in marking, scaling, and tallying the sale volume. For the owner who sells logs at roadside and does his own logging, conversion surplus is computed as roadside log price less marking and scaling costs as above and all the direct costs of harvesting. The latter are primarily labor costs involved in felling, bucking, skidding, and landing, plus equipment operating costs which consist mostly of the operator's time and fuel expenses. The owner selling logs at the mill should use delivered prices and subtract additional direct costs of loading, hauling, and unloading at the mill to arrive at conversion surplus. The owner who processes his logs into lumber should use lumber sales price as a basis of valuation and subtract the direct costs associated with sawing, grading, piling, drying, and selling which, for him, are in addition to those mentioned for other owners. This same general procedure would apply in the case of products other than lumber and ultimately, whatever the product, all prices and direct costs must be related to individual trees by species, grade, and size.

Financial maturity guide tables give tree values and typical growth rates for trees of different vigor. Rate of value increase is calculated by solving the formula $(1 + r)^n = \frac{Vn}{Vo}$ for r with the use of compound interest tables. Such rates, when computed, are averages for a particular tree grade, size, and vigor class and can be used to estimate the expected rate of value increment for similar trees between now and the next anticipated marking date.

In addition to its application in the financial maturity concept, conversion surplus has the added utility of providing a justifiable basis for determining relative profitability of harvesting, converting, and selling lumber or other products from trees of different size and grade. The higher its conversion surplus value the more a tree, log, or other timber product contributes to payment of fixed costs or profits. A tree or timber product with a

[1] r is the rate expressed as a decimal; n, the time to the next scheduled cut; Vo, present tree value; Vn, expected tree value n years hence.

zero conversion surplus will just pay the direct costs of processing and marketing and contribute nothing to payment of fixed costs or profits. The tree of negative conversion surplus will not permit recovery of the full amount of the direct costs and will, therefore, involve a loss in harvesting and processing. Thus, conversion surplus provides a guide to the relative profitability of processing alternative trees or timber products as well as a basis for estimating financial maturity.

Use of the Concept

In the case of individual trees the financial maturity principle is relevant primarily after a decision has been reached to make a partial cut in a particular stand. Then it is useful in making choices between trees to cut and trees to leave so as to assure maximum income from all the resources the investment in the stand represents. This maximum will be realized by leaving, until the next scheduled cut, the maximum value in individual trees per acre growing at or above the alternative rate. Of course, the maximum value of residual stand per acre should meet silvicultural requirements for maintenance of site quality, desired influence on quality development in other trees, and desired composition of regrowth. On the other hand, the trees marked for harvest should satisfy the requirements for an operable cut. In order to meet these requirements it may be necessary to cut some trees growing above the alternative rate or leave some growing below the alternative rate.

It should also be noted that under a system of partial cutting the financial maturity principle can be helpful in determining whether an operable volume is ready for harvest. If the requirements of an operable cut are known, a stand can be examined to determine whether the value growth rate of enough trees is expected to fall below the guiding rate so as to constitute an operable volume.

The utility of the financial maturity concept is not limited to situations where the owner has a specific alternative rate of return in mind. Using one guide or another, decisions are frequently made to remove a certain proportion of growing stock without reference to an explicit alternative rate. Such is likely to be the case when a forest owner harvests part of his stand to meet a need for raw material or capital, e.g., provide logs for a sawmill, finance a debt, or obtain working capital. In such situations the financial maturity principle suggests the removal first of those trees promising the lowest rates of value increase; then trees with successfully higher rates of increase. The basis for selecting trees to leave and to harvest would be the value increment of the trees involved and some additional standard such as spacing or desired cut or residual stand per acre. However, if suitable stock and stand tables are available, the cutting budget could be applied to these tables to derive an alternative rate. In either case, the alternative rate will be implicitly determined in the harvested stand. Thus, even though an alternative rate is not explicitly provided, it can be derived approximately from the actual cut for the information of management.

Where there is a choice of cutting one of two or several trees, the alternative rate-growth rate comparison can be used as the exclusive guide for the decision only where the trees have approximately the same conversion surplus value. Such choices occur where the value increments of the several trees involved have fallen, or are expected to fall, below the alternative rate in the next cutting period and removal of one or more would release the remaining sufficiently to bring or maintain their value increment at or above the alternative rate in the next period. If there is a notable difference in value between the alternative trees, but all are expected to grow at the same rate after the cut, the returns to the forest owner will be greater in the next cutting period if the higher value trees are left, other things being equal. This is simply because a twelve dollar tree appreciating at six percent will earn more than a ten dollar tree growing at the same rate.

Now it is true that differences in value which arise from differences in tree species, quality, or size must be taken into account in using the financial maturity principle to discriminate between alternative trees for cutting. However, in favoring the more valuable species, the larger sizes, and the better quality trees, the forester needs to evaluate the effects of this practice upon the current earnings of the business as well as upon the production of the forest in subsequent harvests. A tendency to mark only the poorer species and the smaller size and lower quality trees affects the marketability and selling price of the marked timber adversely, while enhancing the marketability and selling price of prospective future cuts. These effects tend to be multiplied in the case of the vertically integrated operator who usually anticipates a margin for profit at each successive processing stage in which he engages beyond the sale of stumpage. The forester applying the financial maturity principle, therefore, needs to keep one eye on the current market or profits and the other on the future. In other words, he must strike the balance in marking which will maximize the contribution of the forest property to the business of the owner during the period the owner expects to retain an interest in the forest's value and productivity.

Some Additional Points

In applying the financial maturity guide to selection of trees to leave for continued growth, risk of decadence and mortality in the time until the next cut, and sometimes beyond, needs to be considered. The principle implicitly requires an appraisal of risk of loss as a part of the decision. Naturally, any tree having positive conversion surplus, which is not expected to survive the next cutting cycle, should be marked now regardless of its value growth rate. Trees which are highly susceptible

to disease or insect infestation as a result of injury or other causes should be favored for cutting. These considerations simply acknowledge that some of the costs involved in holding trees over to the next harvest are associated with mortality and decadence which in turn may lower the expected rate of value increase to the point where it becomes more profitable to remove such trees rather than risk losing them.

Anticipated price behavior likewise should enter into the financial maturity decision. When prices are expected to rise in the next cutting period, without corresponding increases in costs of conversion, value increment includes the differential due to the price rise as well as the expected value increase based on the current price level. Thus, trees that might be financially mature at current prices may be held profitably until the anticipated price rise becomes effective. Likewise, trees that are not financially mature may become so in light of an anticipated price fall without a corresponding drop in conversion costs.

It is sometimes observed in the case of the vertically integrated forest business that trees which are not yet financially mature have to be cut or else the firm will have to purchase raw materials in the open market at prices higher than average in order to maintain a given level of production. In such cases the conversion surplus value of trees that would meet the raw material rises by the amount of net income the business would lose by the impending shut down, cut back, or temporarily increased cost of purchased raw material. In these emergencies current tree values are higher than anticipated tree values at some future date under stable conditions of wood supply. This effects a drop in the anticipated rate of value increment in all trees owned by such a firm and results in many trees becoming financially mature.

These additional considerations indicate the further utility of the financial maturity concept in dealing with the practical considerations in the forest business. They demonstrate that the economy of the forest business is dynamic and that judgment needs to be exercised to modify the static analysis which would be given by a less flexible financial maturity guide or any other calculation based on the assumption of stable prices and interest costs.

Conclusion

The financial maturity principle has been developed largely for the purpose of providing a guide to timber growing based on individual tree selection. Basically, its application requires two measurements: (1) tree value and the expected value growth percent of the tree between now and the next anticipated cut; (2) some measure, either explicit or implicit, of the alternative rate of return demanded by the forest owner. If the alternative rate is greater than the tree's expected value growth rate the tree is financially mature. The decision may be altered, however, if additional net values or costs associated with market expectations, conversion operations, raw material requirements, growth of other trees, or reproduction of the stand are sufficiently great. These considerations, which are additional to the value increment of the tree itself, are frequently difficult to measure objectively or to standardize; therefore, their evaluation must rest heavily upon the experience and judgment of the forester. These points, once understood, should not deter the practical use of the financial maturity concept.

For all practical purposes the logic underlying the financial maturity principle is identical with that of any other system of choosing trees to cut now and those to leave for future income, where the objective is maximization of net returns to the entire business. Any defensible method of tree marking must consider the additional value which may be earned by leaving the tree for future growth as compared with the value realizable from harvesting it.

The application of judgment in comparing financial alternatives in forest management is inescapable, for the forest business cannot afford a thorough analysis of every tree in the stand. The financial maturity principle and the basic guide tables which are being developed by research foresters provide a practical means for minimizing the vagaries of judgment, and thereby are contributing to a more successful choice among alternatives in the business of growing timber.

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A Guide To Sources of Information Regarding Interesting Forestry Developments In The South

(See Map on Following Pages)

For the 1951 annual meeting of the Society held in Biloxi, Mississippi a committee prepared "A Guide Map to Places in the South with Practices and Activities of Interest to Foresters" (see JOURNAL OF FORESTRY, November 1951). The purpose was to aid visitors in finding places of interest which they might wish to visit going to or from the meeting.

The committee selected for a similar assignment for the 1956 meeting in Memphis decided it could do no better than bring the information of the previous committee up to date. In order to do this it was necessary to circulate agencies and individuals in all states concerned for revisions, additions, and deletions. In response there were so many worthy additions suggested that the committee was overwhelmed to know what to do in view of the limited space available in the JOURNAL. It hesitated to assume the prerogative of eliminating suggested places of interest because, it seemed, nearly all were of equal importance.

After due deliberation it was decided to alter the type of information substantially for the 1956 meeting. Rather than attempting to show all places of interest on a map together with adequate cataloguing of their features it was decided to list agencies by states which would be in position to supply information on important developments pertaining to forestry and the forest industries in the respective States. Thus foresters in planning their routes to and from the meeting would have a convenient guide to sources of authentic information on such forestry developments as they may wish to observe. Or travelers to and from the meeting may wish to stop on the way and discuss developments with representatives of the agencies listed and shown on the map.

It is with apologies to the previous committee which did such a splendid job in preparing a guide for the 1951 annual meeting, and with the foregoing explanation, the current committee submits the map and information herewith for the use of travelers to the 1956 annual meeting. In the five years since 1951, forestry in the South has continued to develop and advance at an accelerated rate. Progress is evident in every direction—research, demonstration, on-the-ground application, and in industrial development. There seems to be at least one item of outstanding significance in nearly every section of each state. It is hoped that you will correspond with the foresters in this section in advance of your travel so they may make specific arrangements to show you firsthand, items of major interest to you. As your hosts, Society members of the southern states are looking forward to the opportunity of meeting you and showing you the rapid strides being made in forestry in the South.

Committee:

JOHN A. PUTNAM — KENNETH J. SEIGWORTH
GORDON CONDIT — JOHN N. TYLER
E. R. DESILVIA — CARL I. PETERSON

Alabama

1. Alabama Polytechnic Institute, Department of Forestry, Auburn.
2. Extension Forester, Alabama Polytechnic Institute, Auburn.
3. Alabama Department of Conservation, Division of Forestry, 711 High Street, Montgomery.
4. State Soil Conservationist, Alabama Polytechnic Institute, Auburn.
5. State Department of Conservation, Game and Fish Division, 7 North Bainbridge Street, Montgomery.
6. Alabama National Forests, U. S. Forest Service, P. O. Box 40, Montgomery Divisions: Conecuh, 83,426 acres; Talladega, 264,610 acres, William B. Bankhead, 156,215 acres; Flat Top Experimental Forest, North Central Alabama, 653 acres.
7. Birmingham Research Center, Southern Forest Experiment Station, Room 267, Federal Building, Birmingham.
8. Alabama Forest Products Association, P. O. Box 422, Montgomery.

Arkansas

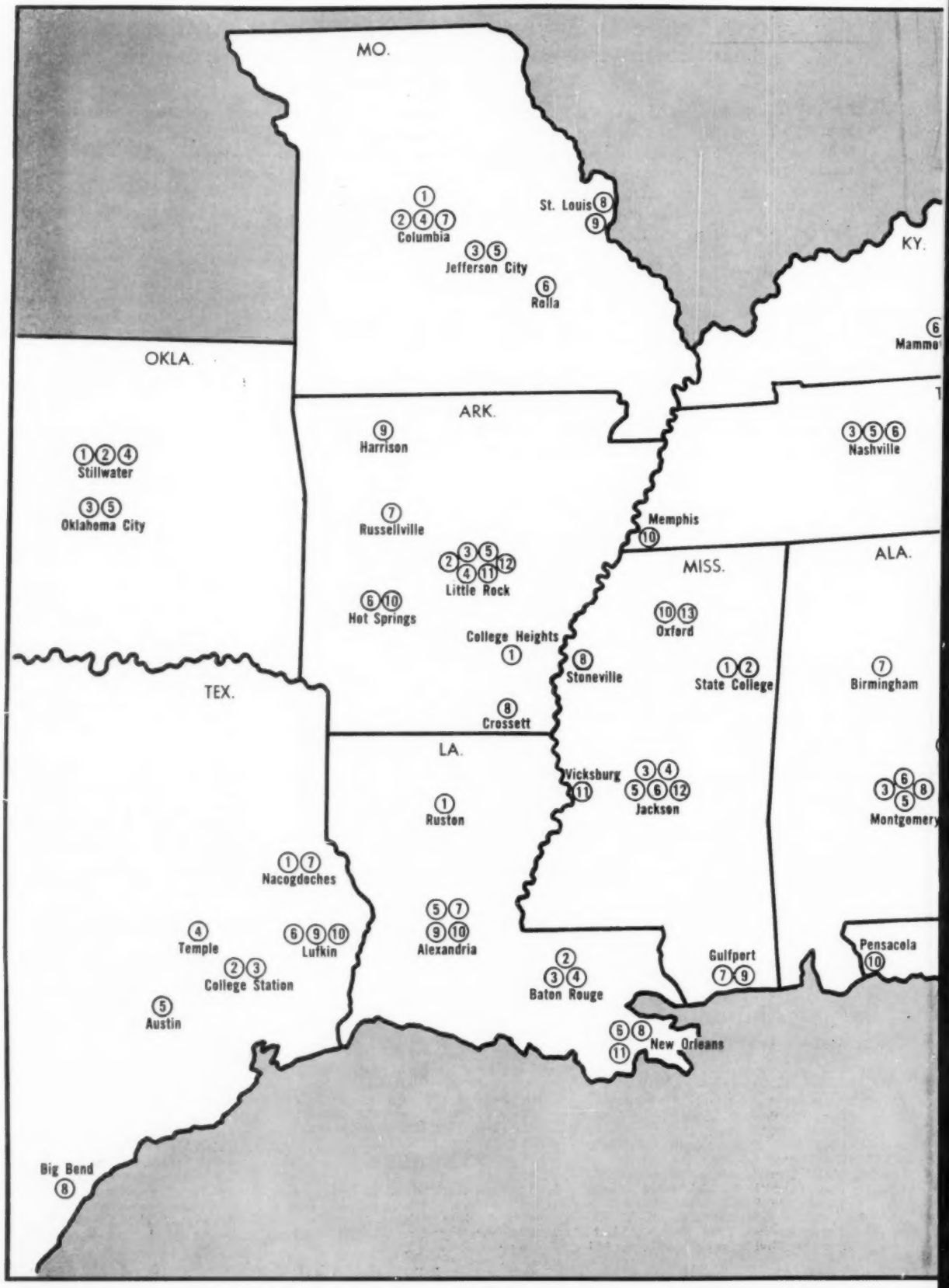
1. Arkansas Agricultural and Mechanical College, Department of Forestry, College Heights.
2. Extension Forester, 421½ W. Capitol Avenue, Little Rock.
3. Arkansas State Forestry Commission, P. O. Box 1940, Little Rock.
4. State Soil Conservationist, 223 Federal Building, Little Rock.
5. State Game and Fish Commission, Game and Fish Building, Little Rock.
6. Ouachita National Forest, U. S. Forest Service, Federal Building, Hot Springs National Park.
7. Ozark National Forest, U. S. Forest Service Building, Russellville.
8. Crossett Research Center, Southern Forest Experiment Station, Crossett.
9. Central Ozarks Research Center, Southern Forest Experiment Station, Harrison.
10. Hot Springs National Park, Box 859, Hot Springs.
11. Arkansas Wood Products Association, Union Life Building, Little Rock.
12. Keep Arkansas Green Association, Boyle Building, Little Rock.

Florida

1. University of Florida, School of Forestry, Gainesville.
2. Extension Forester, College of Agriculture, University of Florida, Gainesville.
3. Florida Forest Service, P. O. Box 1200, Tallahassee.
4. State Soil Conservationist, P. O. Box 162, Gainesville.
5. Game and Fresh Water Fish Commission, 648 W. Tennessee, Tallahassee.
6. Florida National Forests, U. S. Forest Service, P. O. Box 1050, Tallahassee. Divisions: Apalachicola, 292,625 acres; Ocala, 190,516 acres; Osceola, 157,231 acres.
7. East Gulfcoast Research Center, Southern Forest Experiment Station, P. O. Box 900, Marianna.
8. Lake City Research Center, Southeastern Forest Experiment Station, 200 Postoffice Building, Lake City.
9. Everglades National Park, Box 275, Homestead.
10. Florida Forestry Association, 616 Brent Annex, Pensacola.

Georgia

1. University of Georgia, School of Forestry, Athens.
2. Extension Forester, College of Agriculture, University of Georgia, Athens.
3. Georgia Forestry Commission, Box 1183, Macon.
4. State Soil Conservationist, Old Post Office Building, Athens.
5. State Game and Fish Commission, 412 State Capitol, Atlanta.
6. Chattahooche National Forest, U. S. Forest Service, Box 643, Gainesville.
7. University of Georgia Field Research Center, Athens.
8. Cordele Research Center, Southeastern Forest Experiment Station, 200 Post Office Building, Athens.
9. Southern Region (Region 8), U. S. Forest Service, 50 Seventh Street, N. E., Atlanta 5.


MO.
KY.
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St. Louis 8 9
Jefferson City 3 5
Rolla 6
Harrison 9
Stillwater 1 2 4
Oklahoma City 3 5
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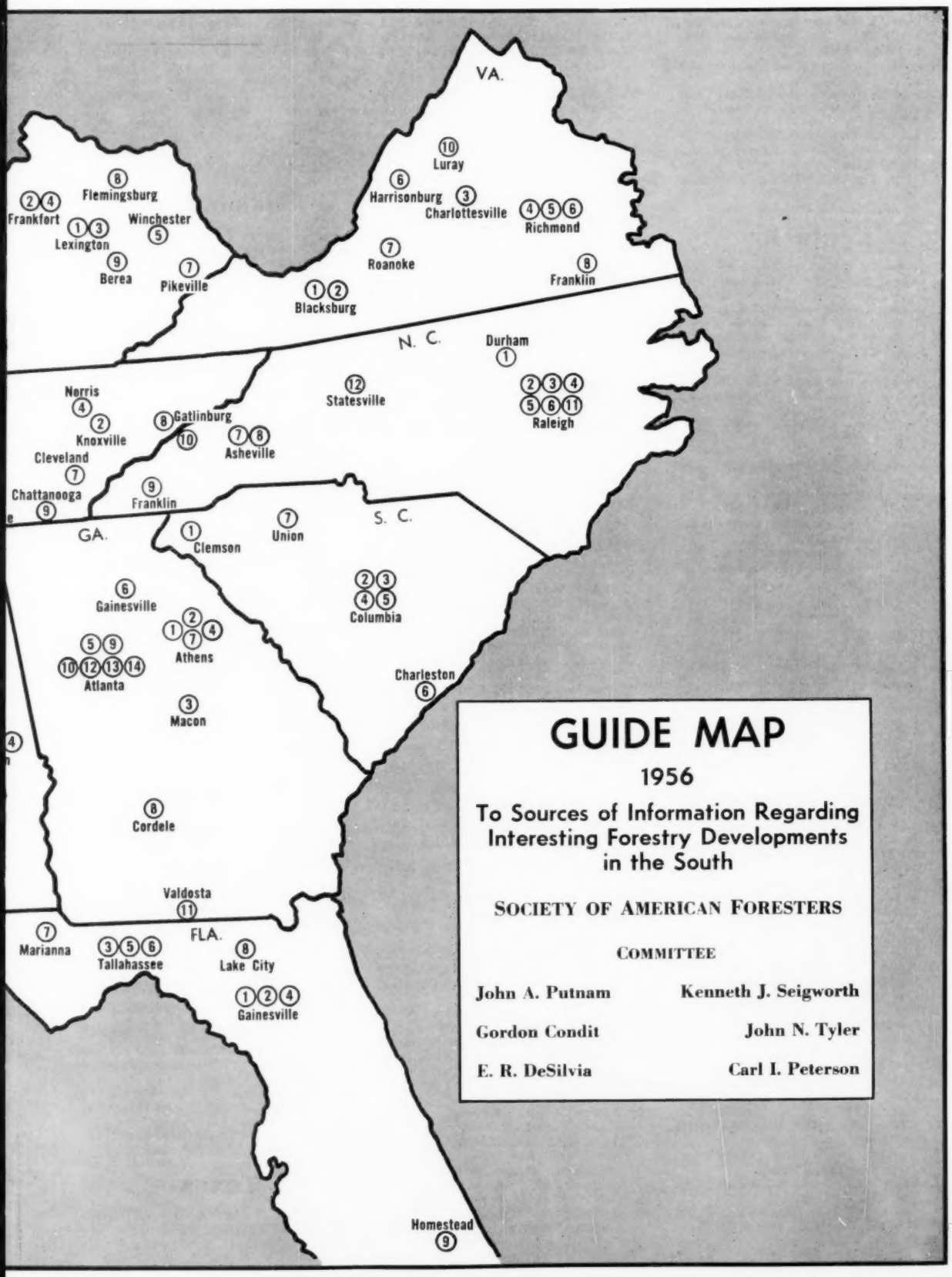
Little Rock 2 3 4 5 11 12
Hot Springs 6 10
College Heights 1
Stoneville 8
Crossett 8
Memphis 10
Nashville 3 5 6
Oxford 10 13
State College 1 2
Birmingham 7
Vicksburg 3 4 5 6 11 12
Jackson
Ruston 1
Nacogdoches 1 7
Temple 4
Lufkin 6 9 10
College Station 2 3
Austin 5
Alexandria 5 7 9 10
Baton Rouge 2 3 4
Gulfport 7 9
Pensacola 10
New Orleans 6 8 11
Big Bend 8



GUIDE MAP

1956

To Sources of Information Regarding Interesting Forestry Developments in the South

SOCIETY OF AMERICAN FORESTERS

COMMITTEE

John A. Putnam — Kenneth J. Seigworth

Gordon Condit — John N. Tyler

E. R. DeSilvia — Carl I. Peterson

10. Georgia Forestry Association, Inc., Room 905, C & S National Bank Building, Atlanta.
11. American Turpentine Farmers Association, Valdosta.
12. Forest Farmers Association Cooperative, 66 Eleventh Street, N. E. Atlanta.
13. Southern Pulpwood Conservation Association, 1224 Peachtree Street, N. E. Atlanta.
14. U. S. Fish and Wildlife Service, Regional Office, 50 Seventh Street, N. E., Atlanta 5.

Kentucky

1. Extension Forester, College of Agriculture, University of Kentucky, Lexington.
2. Department of Conservation, Division of Forestry, New Capitol Annex, Frankfort.
3. State Soil Conservationist, 231 Maxwell Street, Lexington.
4. Department of Fish and Wildlife Resources, New State Office Building, Frankfort.
5. Cumberland National Forest, U. S. Forest Service, Federal Building, Winchester.
6. Mammoth Cave National Park, Mammoth Cave.
7. Eastern Kentucky Forest Fire Protective Association, Pikeville.
8. Kentucky Conservation Council, 140 Elizaville Avenue, Flemingsburg.
9. Berea Forest Research Center, Central States Forest Experiment Station, Berea.

Louisiana

1. Louisiana Polytechnic Institute, Department of Forestry, Ruston.
2. Louisiana State University, School of Forestry, Baton Rouge.
3. Extension Forester, State University, University Station, Baton Rouge.
4. Louisiana Forestry Commission, P. O. Box 1269, Baton Rouge.
5. State Soil Conservationist, Svebeck Building, Alexandria.
6. Louisiana Wild Life Fisheries Commission, 126 Civil Courts Building, New Orleans.
7. Kisatchie National Forest, U. S. Forest Service, Federal Building, Alexandria.
8. Southern Forest Experiment Station, U. S. Forest Service, 704 Lowich Bldg., 2026 St. Charles Avenue, New Orleans 13.
9. Alexandria Research Center, Southern Forest Experiment Station, Agricultural Building, Alexandria.
10. Louisiana Forestry Association, P. O. Box 279, Alexandria.
11. Southern Pine Association, 520 National Bank of Commerce, New Orleans 4.

Mississippi

1. Mississippi State College, Department of Forestry, State College.
2. Extension Forester, Mississippi State College, State College.
3. Mississippi Forestry Commission, P. O. Box 649, Jackson.
4. State Soil Conservationist, P. O. Box 610, Jackson.
5. Game and Fish Commission, P. O. Box 451, Jackson.
6. Mississippi National Forests and Yazoo-Tallahatchie Flood Prevention Project Headquarters, P. O. Box 1144, Jackson. Divisions: Bienville, 175,427 acres; Delta, 58,956 acres; DeSoto, 50,044 acres; Holly Springs, 123,066 acres; Homochitto, 189,127 acres; McNeil Experimental Forest, 1,211 acres.
7. Southern Institute of Forest Genetics, P. O. Box 51, U. S. D. A. Building, 3505 25th Street, Gulfport. (Field Station on Harrison Experimental Forest, near Saucier).
8. Delta Research Center, Stoneville.
9. Forest Insect Laboratory, P. O. Box 51, U. S. D. A. Building, 3505 25th Street, Gulfport.
10. Tallahatchie Research Center, Dupres Hall B, University of Mississippi, P. O. Box 108, Oxford.
11. Vicksburg Infiltration Project, Waterways Experiment Station, Vicksburg.
12. Mississippi Forestry Association, 311 Millsaps Building, Jackson.
13. Yazoo-Tallahatchie Flood Prevention Project, Oxford. (Headquarters of project manager).

Missouri

1. University of Missouri, Forestry Department, Columbia.
2. Extension Forester, College of Agriculture, University of Missouri, Columbia.
3. Missouri Conservation Commission, Forestry Division, Monroe Building, Jefferson City.
4. State Soil Conservationist, P. O. Box 180, Columbia.
5. State Conservation Commission, Monroe Building, Jefferson City.
6. Missouri National Forests, U. S. Forest Service, Rolla.
7. Columbia Research Center, Central States Forest Experiment Station, Room 45 Forestry Building, University of Missouri, Columbia.
8. Associated Cooperage Industries of America, Inc., 408 Olive Street, St. Louis 2.
9. Railway Tie Association, 1221 Locust Street, St. Louis 3.

North Carolina

1. Duke University, School of Forestry, Durham.
2. North Carolina State College, School of Forestry, Raleigh.
3. Extension Forester, North Carolina State College, Raleigh.
4. North Carolina Department of Conservation and Development, Division of Forestry, Education Building, P. O. Box 2719, Raleigh.
5. State Soil Conservationist, North Carolina State College, Raleigh.
6. North Carolina Wildlife Resources Commission, P. O. Box 2919, Raleigh.
7. Southeastern Forest Experiment Station, U. S. Forest Service, 225 Federal Building, Asheville.
8. North Carolina National Forests, U. S. Forest Service, City Hall Building, Asheville. Divisions: Croatan, 154,891 acres; Nantahala, 372,186 acres; Pisgah, 467,668 acres; Uwharrie, 40,526 acres.
9. Coweeta Hydrologic Laboratory, Southeastern Forest Experiment Station, Franklin.
10. Great Smoky Mountains National Park, Gatlinburg, Tennessee.
11. North Carolina Forestry Association, P. O. Drawer 2946, Raleigh.
12. Cooperative Forestry Project in Piedmont Hardwoods, Statesville, N. C. (Furniture, Plywood and Veneer Council, Southeastern Forest Experiment Station, Duke Power Company, and North Carolina Forestry Association.)

Oklahoma

1. Oklahoma A. & M. College, Department of Forestry, Stillwater.
2. Extension Forester, Oklahoma A. & M. College, Stillwater.
3. Oklahoma Planning and Resources Board, Division of Forestry, 536 State Capitol, Oklahoma City.
4. State Soil Conservationist, Stillwater.
5. Oklahoma Game and Fish Department, 118 State Capitol Building, Oklahoma City.

South Carolina

1. Extension Forester, Clemson Agricultural College, Clemson.
2. South Carolina State Commission of Forestry, 506 Calhoun Office Building, Columbia.
3. State Soil Conservationist, 1401 Hampton Street, Columbia.
4. South Carolina Wildlife Resource Department, P. O. Box 360, Columbia.
5. South Carolina National Forests, U. S. Forest Service, 1401 St. Hampton Street, Columbia. Divisions: Francis Marion, 245,148 acres; Sumter, 317,906 acres.
6. Charleston Research Center, Southeastern Forest Experiment Station, 601 People's Building, Charleston. (Santee Experimental Forest.)
7. Piedmont Research Center, Southeastern Forest Experiment Station, P. O. Box 257, Union.

Tennessee

1. University of the South, Department of Forestry and Engineering, Sewanee.
2. Extension Forester, University of Tennessee, Knoxville.
3. Tennessee Department of Conservation, Division of Forestry, 205 Cordell Hull Building, Nashville.
4. Tennessee Valley Authority, Division of Forestry Relations, Norris.
5. State Soil Conservationist, U. S. Courthouse, Nashville.
6. Tennessee Game and Fish Commission, Cordell Hull Building, Nashville.
7. Cherokee National Forest, U. S. Forest Service, Cleveland.
8. Great Smoky Mountains National Park, Gatlinburg.
9. Keep Tennessee Green Association, % Corley Manufacturing Company, Chattanooga.
10. Southern Hardwood Producers, Inc., 805 Sterick Building, Memphis.

Texas

1. Stephen F. Austin College, Department of Forestry, Nacogdoches.

2. Extension Forester, Texas A. & M. College System, College Station.
3. Texas Forest Service, Texas A. & M. College System, College Station.
4. State Soil Conservationist, P. O. Box 417, Temple.
5. Texas Game and Fish Commission, Austin.
6. Texas National Forests, U. S. Forest Service, P. O. Box 380, Lufkin. Divisions: Angelina, 15,831 acres; Davy Crockett, 161,062 acres; Sabine, 183,788 acres; Sam Houston, 156,095 acres.
7. East Texas Research Center, Southern Forest Experiment Station, % Stephen F. Austin College, Nacogdoches.
8. Big Bend National Park, Headquarters—Big Bend National Park.
9. Texas Forestry Association, P. O. Box 1032, Lufkin.
10. Texas Lumber Manufacturer's Association, P. O. Box 58, Lufkin.

Virginia

1. Virginia Polytechnic Institute, Department of Biology, Section of Forestry and Wild Life Conservation, Blacksburg.
2. Extension Forester, Virginia Polytechnic Institute, Blacksburg.
3. State Department of Conservation and Development, Virginia Division of Forestry, Box 3347, Charlottesville.
4. State Soil Conservationist, 900 North Lombardy Street, Richmond.
5. Commission of Game and Inland Fisheries, P. O. Box 1642, Richmond.
6. George Washington National Forest, Federal Building, Harrisonburg.
7. Jefferson National Forest, Federal Building, Roanoke.
8. Franklin Research Center, P. O. Box 479, Franklin.
9. Virginia Forests, Inc., 301 E. Franklin Street, Richmond.
10. Shenandoah National Park, Luray.

Notes

Mulch Not Beneficial to Seedlings on Deep Sands

Will a mulch of pine needles increase the survival of pines planted on denuded sandhills sites? How does mulch alter the micro-environment of the seedlings? A study to answer these questions was carried out at the Chipola Experimental Forest in west Florida.

Four blocks of paired plots, mulched and unmulched, were established on excessively drained Lakeland sands having a low water storage capacity. Scrub oaks and wiregrass had previously been scalped from the planting areas with a bulldozer. Longleaf pinestraw was applied two inches thick for a radius of 18 inches around mulched seedlings. Longleaf and slash pines (*Pinus palustris* Mill., and *P. elliottii* var. *elliottii*) were the test species.

The test was installed in 1953 and replicated in 1954. In 1954 an additional pair of slash pine plots was established for the purpose of studying differences in the micro-environment of mulched and unmulched seedlings. Soil surface temperatures were measured with a mercury thermometer, the bulb of which was placed ⅛-inch below the surface of the soil. A similar thermometer was used to measure temperatures inside the mulch. Sub-surface temperatures were measured with thermistors buried when seedlings were planted. Soil samples were taken during the growing season for moisture and pH determination.

The mulch did not increase early survival of the seedlings. Survival of non-mulched seedlings (Table 1) was slightly superior to that of mulched seedlings. The differences were seldom significant, but it is possible that a more intensive study would definitely show that mulching lowered survival.

Surface temperatures of the bare sand were as high as 143° F. Temperatures within the mulch sometimes exceeded 160°, well above the generally accepted lethal range of 130-135°. Concurrent readings at the soil surface immediately under the mulch were as much as 59° cooler. The mulch seemed to act as a heat trap. The great range of temperature within a vertical distance of an inch emphasizes the importance of microclimates in seedling survival studies. Soil temperatures under the bare spots were higher than under the mulched spots but in neither case did they reach 135°.

TABLE 1.—SURVIVAL OF MULCHED AND UNMULCHED PINE SEEDLINGS PLANTED ON DENUDED SANDHILLS SITES

Year and species	First-year survival	
	Not mulched	Mulched
	Percent	*Percent*
1953		
Longleaf	59	53
Slash[1]	98	77
1954		
Longleaf	31	31
Slash	90	82

[1]Survival was significantly less (at the 5-percent level) for mulched seedlings.

Soil moisture was not significantly increased by mulch. Losses by evaporation from the bare soil and mulched soil were both small.

Electrometric pH determinations revealed no differences that could be attributed to mulch. The normal pH ranged around 4.8 to 5.0, with the upper three inches averaging slightly higher than the lower soil layers. This small latitude is not wide enough to influence root-soil relationships effectively.

Swelling, pitch streak development, and insect damage were noted on many seedling stems at the level of the mulch. It was not possible to determine whether the insect injury was primary, or followed possible heat injury to the stem.

All surviving seedlings from both the 1953 and 1954 plantings were dug and weighed in 1955. Mulching apparently had no effect on gross seedling weight.

In sum, mulch did not increase survival of the pines and seems to have promoted a buildup of excessive temperatures around young stems. On the basis of this study, the use of pinestraw mulch is not recommended for seedlings planted on sandhill sites.

F. W. WOODS, E. A. HEBB, and D. L. FASSNACHT
Southern Forest Experiment Station, Forest Service, U. S. Department of Agriculture

Effect of Pruning on the Recovery of Ice Bent Slash Pines[1]

Ice storms, which periodically ravage young pine stands in the South, cause damage which may be of several types: (1) on shallow soils, trees may be uprooted or root sprung; (2) stem breakage may occur, especially in the crowns; and (3), most common in stands of large saplings and small poles, trees suffer slight to severe bending. It is this last type of damage, bending, with which this report is concerned.

A rather severe ice storm visited the State College, Mississippi vicinity on February 8 and 9, 1948. As was reported in a previous study,[2] on February 27 and March 5, 1948, twenty-four bent slash pines were pruned to the leader to see if relieving the crown load (branch weight; the ice load was long since gone) would result in straightening. For the most part, the trees did straighten immediately on pruning. Nine of the pruned pines were bent 30° to 60° off vertical and fifteen were bent horizontal. By horizontal is meant trees the main stems of which were at some point parallel with the ground. For each pruned tree, a nearby tree of approximately the same diameter and lean was tagged and left unpruned (Fig. 1).

The trees were remeasured on January 24, 1949. At that time, of those which had suffered horizontal bending, all but one of the pruned trees were straight (less than a 10° lean). This particular tree with a 10° to 30° lean had the crown of an adjacent tree leaning into it. None of the unpruned trees with a horizontal bend was straight. For those trees which had been bent 30° to 60° off vertical, pruning had no advantage over no pruning; all but one tree each, pruned and unpruned, had straightened.

In February, 1951, a second, more severe ice storm visited the same area.

The trees were inspected again on February 8, 1956. After a lapse

[1]Published with the approval of the director, Mississippi Agricultural Experiment Station as Journal Article No. 583.

[2]Roberts, E. G. and R. T. Clapp. Pines severely damaged by ice recover after pruning. Miss. Farm Res. Vol. 12, No. 5, pp. 1,5. 1949.

FIG. 1.—Photograph one year after pruning. Tree on left unpruned; tree on right pruned. Ten foot poles give idea of tree heights.

FIG. 2.—Photograph eight years after ice storm. The tree on the left was horizontal; the tree on the right was leaning. Both were pruned to the leader.

of eight years only half of the original trees could be identified. Some may have lost their tags and others may have been destroyed by the second ice storm. Of the five trees horizontal and unpruned in 1948 which were found, one had become straight and four were crooked. Of the five leaning, unpruned trees, all were straight. Of six horizontal, pruned trees, four were straight, one had sweep caused by an adjacent winged elm, and one was leaning presumably because of the crown of an adjacent more dominant pine (Fig. 2). Of six leaning, pruned trees, three were straight, two were classified as being borderline cases between straight and crooked, and one, the top of which was caught under the branch of an adjacent tree, was leaning (Table 1). The following conclusions drawn in the earlier report still seem valid; (1) virtually all trees with a bend of less than 60° off vertical may be expected to straighten without pruning, (2) few of those that are still horizontal three or four weeks after an ice storm will become straight unless pruned, while (3) with pruning to the leader, virtually all will become straight. No data are at hand on the response of slash pines to less severe pruning, to pruning delayed longer after an ice storm, or to the responses of trees with a 60° to 90° lean.

As would be expected, growth rate suffered temporarily from the severe pruning. In the first growing season after pruning the pruned trees made an average diameter growth of only 0.3 inch whereas the unpruned trees grew 0.7 inch. In the following seven years the pruned trees increased in diameter an average of 2.2 inches, or 0.31 inch a year, while the unpruned trees grew 2.5 inches, or 0.36 inch a year. The pruned trees are gradually overcoming the depression in growth rate caused by severe crown reduction. With 1949 diameters as a base, the unpruned trees have increased 65.8 percent in diameter and the pruned trees 64.7 percent. The pruned trees have grown new crowns, while the lower portions of the crowns on the unpruned trees have died as a result of shading. There is now no apparent difference between the pruned and the unpruned trees in the ratio of live crown to total height.

The temporary reduction in diameter growth resulting from severe pruning after ice bending seems to be a small price to pay for the better tree form obtained.

TABLE 1.—DEVELOPMENT OF PRUNED AND UNPRUNED ICE BENT TREES

Pruning[1]	Feb. 27, '48–Mar. 5, '48 D.b.h.	Bend[2]	Jan. 24, '49 D.b.h.	Bend[2]	Feb. 8, '56 D.b.h.	Bend[2]	Remarks
P	4.0	H	4.3	S			
U	4.0	H	5.6	L			
P	2.2	H	2.5	S			
U	2.6	H	3.3	C			
P	3.6	H	4.1	S			
U	3.9	H	4.5	C	7.5	S	
P	4.0	H	4.2	S			
U	4.1	H	4.8	L			
P	3.4	L	3.6	S	6.4	S	
U	3.7	L	4.6	S	7.5	S	Top broken in 1951 ice storm.
P	2.4	H	2.6	S	4.4	C	Sweep caused by adjacent winged elm.
U	2.3	H	3.0	C			
P	3.1	H	3.3	S	5.0	L	Lean caused by crown of adjacent more dominant pine.
U	2.5	H	3.5	S			
P	3.2	L	3.5	S			
U	3.1	L	3.9	S	7.3	S	
P	3.5	H	3.8	S			
U	3.5	H	4.2	L			
P	3.0	H	3.1	S	5.3	S	Top broken in 1951 ice storm.
U	3.5	H	4.3	L			
P	3.6	L	3.9	S	6.8	S	
U	3.6	L	4.3	S	6.2	S	Top broken in 1951 ice storm.
P	3.8	H	3.9	S	6.2	S	
U	3.2	H	3.9	L	7.0	C	
P	3.1	L	3.4	S			
U	3.2	L	4.6	S			
P	2.3	H	2.9	S			
U	2.2	H	2.6	C	4.1	X	Low break in crown in 1951 ice storm.
P	3.2	H	3.5	S			
U	3.6	H	4.8	C	7.9	C	
P	4.0	H	4.1	10°-30°	6.0	S	In 1949 adjacent tree leaning into it. Top broken in 1951 storm.
U	3.4	H	4.2	C	6.8	C	Much sweep.
P	3.5	L	4.0	S	5.0	L	Caught under branch of adjacent tree.
U	3.3	L	3.7	S	5.9	S	
P	3.3	L	3.5	S			
U	3.1	L	4.1	S			
P	2.7	L	3.1	S	5.5	S?	Borderline case in form between S and C.
U	2.5	L	3.1	S	5.8	S	
P	2.5	H	2.9	S	4.6	S	
U	2.3	H	2.9	C	4.6	C	Top broken in 1951 ice storm.
P	4.2	H	4.5	S			
U	4.1	H	4.9	10°-30°			
P	2.5	L	2.9	S	6.2	S	
U	2.3	L	3.2	S			
P	3.1	L	3.4	10°-30°	5.8	S?	Borderline case in form between S and C.
U	2.6	L	3.5	10°-30°			
P	2.7	H	3.0	S			
U	2.3	H	3.1	L	5.3	X	Low break in crown in 1951 ice storm.

[1]Pruning: P = pruned to tip; U = unpruned.

[2]Bend: S = straight, or less than 10° off vertical; C = stem crooked or with sweep but axis vertical; L = 30° to 60° off vertical; 10° — 30° = 10° to 30° off vertical; H = horizontal or greater bend; X = tree too shortened by ice breakage for bending classification.

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A Syringe for Pine Pollination

A plastic syringe developed somewhat as outlined by Perry[1] is being used in the breeding program at the School of Forestry of the University of Georgia. Its use provides a greater margin of safety, eliminating, among pollination hazards, the risk of broken glass with possible resultant laceration and in addition the loss of valuable male germ plasm. It can be filled easily with larger quantities of pollen from a single male parent, and the amount of pollen available can be readily seen through its milky white plastic wails. Not only does this piece of equipment handle easily, but in its manipulation the pollen moves readily.

A 30 c.c. polyethylene syringe (10 cm × 22 mm dia.) used by veterinarians in the treatment of Bovine Mastitis has been adapted to our needs. The plunger has been discarded and in its place is attached a ½ ounce B-D rubber bulb or a one ounce Davol ear and ulcer syringe (No. 526). A rubber stopper (No. 4) bored to size functions as an adapter between the rubber bulb and the plastic syringe barrel. At the business end is a piece of a No. 15 Stub's gauge syringe needle approximately 1½ inches long with less than one inch exposed after the removal of a portion of the plastic tip. (Fig. 1). A possible supplier is the Goshen Laboratories, Inc., Goshen, N. Y. There are others, no doubt. A producer has not been found as yet.

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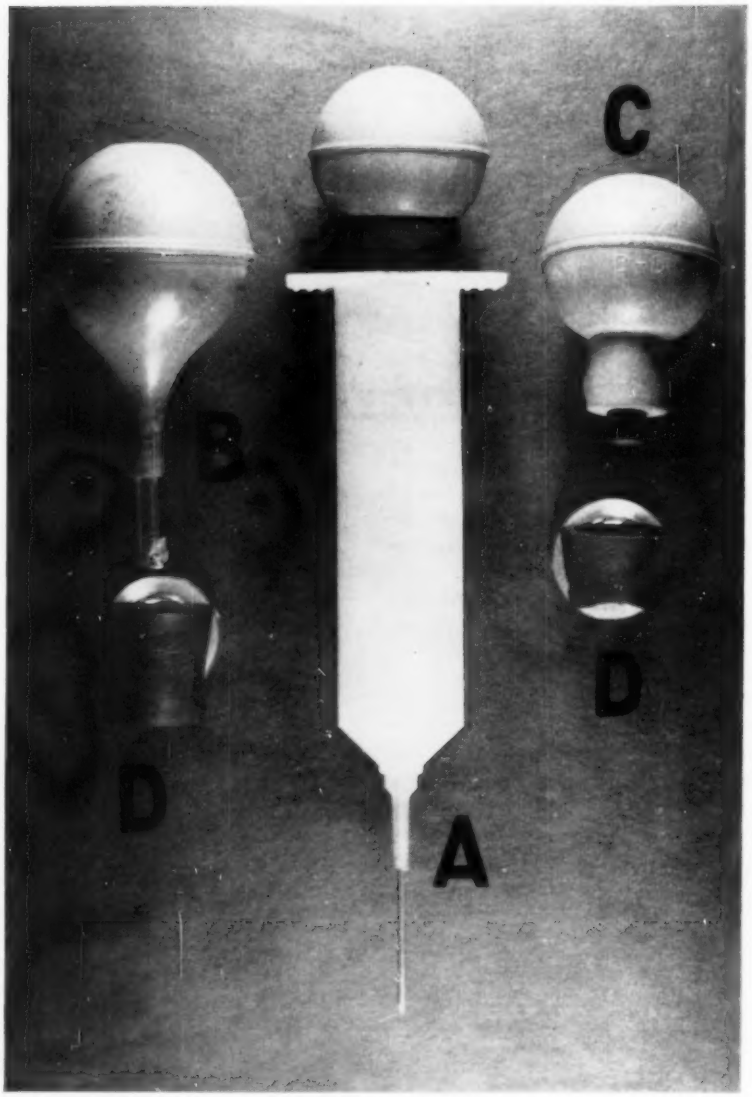

FIG. 1.—(*A*) Assembled syringe, (*B*) One ounce Davol ear and ulcer syringe with constricted glass tubing, (*C*) A ½ ounce B-D "Aseptо" rubber bulb, and (*D*) rubber stopper adapter.

[1]Perry, Thomas O. Controlled pollination of pine species in North America. Jour. Forestry 52:666-671. 1954.

Points of View

The Education and Training of Foresters

Two pieces[1] in the June 1956 JOURNAL OF FORESTRY contain constructive suggestions of the greatest importance for the future of our profession. I am moved to second them at some length because, just after reading them, I heard some searching and well-founded criticism of our professional education by a teacher of botany who instructs forestry students.

For some years, there has been heated discussion of the five-year curriculum in forestry. Meanwhile, this curriculum has become, unrecognized, the training with which a large number of the leaders in our profession have equipped themselves, often, as Mr. Rosecrans suggests, vicariously. This vicarious element in the self-education of the professional will always remain important. Indeed, it is one of the hall-marks of the genuine professional. Nevertheless, the growth of all professions seems to be dependent on a corresponding increase in the degree to which instruction in the fundamentals is formalized. Today, many foresters seem ready to admit that the four-year curriculum is insufficient to include time for the foundations of a liberal education and the basic technical training, but few, particularly among the professional educators, seem able or willing to take the plunge. Perhaps those of us who sit around the edge of the pool can do something more helpful than to urge them in.

Recruiting potential members of our profession is a job which those of us who are not educators are particularly qualified to do. Basically, it is the pattern of our professional life and the satisfactions we derive from it which we must "sell" to our prospects. Above all, we must not sell these things too cheaply. We will not help our profession if we present the forestry curriculum as one which makes slight demands, say in mathematics and foreign languages, of the high-school graduate. Neither will we help our profession to develop if we stress unduly the monetary rewards forestry offers. There are professions whose service to the public has not necessarily kept pace with their remuneration. It will not be enough for us to promote a flow of high-school graduates to the schools of forestry; we must exercise discrimination in two directions. Mr. Rosecrans and my unnamed teacher of botany rightly deplore the too-frequent recruitment of the "young man of pleasant personality, who likes the out-of-doors, but who is not conspicuous for brain power." We must be equally careful not to do young men with personality, interest, and intellect the disservice of packing them off to a second-rate school of forestry, even though that may be a just description of dear old Siwash. Certainly we should try to put across the notion that in education, as in life generally, bargains are often illusory.

Some recent trends make it possible for us to take concrete action on the basis of these generalities. First is the great increase in private and self-employment of foresters. This trend, which has been one of the goals of the public forestry programs, increases the general attractiveness of forestry as a career. Second is the development of Chapter organizations within the Sections of our Society. This makes possible organized contacts between our Society and the high school students of most of the communities in our forested regions. Finally, there is the work of the Committee for the Advancement of Forestry Education and its predecessor committees, which could well be used to direct promising students to schools worthy of their talents.

Mr. Nelson points out, quite concisely, that education and training must continue after graduation. Indeed, the most important attribute which we should expect our schools to foster is the capacity to increase one's own culture and technical competence—in a word: scholarship. Our schools cannot do this if they allow the vocational aspects of the curriculum to dilute instruction in basic sciences and disciplines. Is it possible that those foresters who find the articles in the JOURNAL OF FORESTRY "too technical," and yet are unwilling or unable to submit articles of interest and value to practicing foresters, have been the victims of too highly vocationalized training? Is the "luncheon club" character of some of our professional meetings another symptom?

Those of us who are employers rather than educators must recognize our responsibilities in these matters. We are unreasonable if we ask the schools to turn out seasoned cruisers, scalers, or fire-fighters. We have our training responsibilities. We also have the obligation to make the most effective use of the foresters we employ. This is implied in Mr. Rosecrans' article in which he refers to the need for more ranger-school type of training. Is apprenticeship as a laborer the best type of on-the-job training for the newly employed professional? Can we help to raise the quality of forestry education at all levels by recognizing that not all our jobs require the same level of education and that to use a man at less than his full capacity is to degrade him and waste a valuable resource? The increasing scope of our public and private forestry programs makes it easier and more urgent for us to answer these questions constructively.

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[1]Rosecrans, W. S. The other side of the mountain. Jour. Forestry 54:375-377. 1956.

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Reviews

Arctic Wilderness

By Robert Marshall (edited by George Marshall). 171 pp. Illus. University of California Press, Berkeley, Calif. 1956. $3.75.

Arctic Wilderness is much more than a stirring account of high adventure in the far North. It is an equally superb characterization of a rare personality—a blend of powerful physical and mental drive, unselfish devotion to public service, and an unusual measure of human warmth. Highly stable emotionally, surprisingly free from worldly ambition, untainted by snobbery or prejudice, Bob Marshall numbered among his host of friends an amazing variety of people from Supreme Court justices and Cabinet secretaries to tough Alaskans and simple Eskimos.

Foresters who came in contact with Marshall on official business or at Society or NRA affairs in Washington, or during field work or hikes, well recall his keen, good-humored wit and the ringingly clear logic of his writings and discourse, whether on silviculture, sustained yield, wilderness preservation, or forest policy. Well remembered also are his intense interest in promoting the objectives of the Society of American Foresters and in improving the standards of forest practice. But he will best be remembered for his efforts to maintain the integrity of the national forests, and especially of their dedicated wilderness areas, so largely the fruit of his vision, leadership, and personal examination.

As a highly placed official in the Bureau of Indian Affairs and later in the U. S. Forest Service, Marshall was fully cognizant of the multiple-use commodity and watershed values of the Indian forests and national forests. But he also was farsighted and social-minded enough to recognize the superlative qualities of the undeveloped portions of these same reservations. Like Aldo Leopold and a few other foresters he clearly understood the regenerative powers of wilderness experience in a world of uncertainty and nervous tension. And with Leopold and other kindred spirits he founded the Wilderness Society to help preserve these precious opportunities for all time.

Living as he believed, impelled by an irresistible desire to search out isolated and formidable terrain, Bob chose the vast Brooks Range for a series of explorations during 1929 and the 1930's. *Arctic Wilderness*, edited by his brother George from the author's unpublished writings, maps, and photographs, is the classic result.

Neither the harshness of the blizzard-ridden winter, the sudden onslaughts of swift, turbulent fall or spring floods, nor hordes of mosquitoes in summer daunted Bob and his few hardy companions on their extended sojourns into primeval mountain fastnesses. His matter-of-fact narration cannot hide the stamina, fortitude, and good spirits displayed by the explorers in the face of hardships, mishaps, and near-mishaps. Yet despite the most difficult obstacles to travel—and sometimes even to finding rest and shelter—Bob was able to conduct careful observations and experiments on the physiology of tree growth in Arctic timber-line habitats, and to map accurately and in detail most of the 15,000 square miles of the Upper Koyukuk River drainage beyond the Arctic Circle.

Bob's greatest joys were in pitting his strength against great odds to achieve an objective that stirred his senses. George Marshall comments how Mt. Doonerak and other stark peaks fired Bob's imagination. "He took great pleasure in the ascents themselves and what happened along the way. When he failed to reach the summit he showed his usual objectivity toward his relation to the superior power of natural forces. Views from the summits were deep spiritual experiences. His joy was complete when, standing on some peak never before climbed, he beheld the magnificence of a wild, timeless world extending to the limit of sight filled with countless mountains and deep valleys previously unmapped, unnamed, and unknown."

As a straight-out adventure story, *Arctic Wilderness* is simply hard to beat. The ease with which each exploration can be followed on the various maps compounds the pleasure and avid interest that grip the reader. Foresters, geologists, biologists, or engineers who have also braved the elements in wild mountain country will relive their own experiences. One closes the book with a feeling of kinship and pride in this fellow-forester who, like many others was attracted to our profession as much for the promise of virile contacts with nature on her own terms as for its career opportunities. And who among us hasn't been the happier for it!

BERNARD FRANK
U. S. Forest Service

Submission to Royal Commission on Canada's Economic Prospects

138 pp. Canadian Pulp and Paper Association, Sun Life Building, Montreal, Quebec.

The Royal Commission currently investigating Canada's economic prospects is prompting Canadian businessmen and industries to assess their present position and to take a penetrating look into the future. The forecasts of Canada's pulp and paper industry are of special interest, for this industry accounts for one-quarter of the total value of Canada's exports, one-third of its exports to the United

States, and supplies three-quarters of U.S. newsprint consumption.

In three preliminary sections, the report outlines the development and structure of the Canadian pulp and paper industry. Among the factors that have favored the growth and development of this industry, it lists: (1) an abundance of three basic natural resources—wood, water, and power; (2) the competitive attractiveness of these resources; and (3) the granting by the United States of free entry of newsprint from Canada in 1911 and, in 1913, of the extension of free entry to woodpulp and to newsprint from all sources.

Prospective demands on the Canadian industry, by 5-year intervals to 1980, are discussed in detail by groupings of major products, *viz.*, newsprint, other pulp and paper products, and woodpulp. Total pulp and paper demands are summarized in Section VII and reconciled against present and future potential forest assets in Section VIII.

The most detailed analysis concerns the present and future status of newsprint which, comprising 60 percent of total end-product production of which 93 percent is exported, is the most important segment of the industry. World newsprint requirements by 1980 are predicted to be 26 million tons annually, compared with 13 million tons in 1955 and 10 million in 1950. U. S. consumption is predicted to increase from 6.4 million tons in 1955 to 10.4 million tons in 1980, of which one-third is expected to be supplied by expansion of U. S. mills, particularly in the South, and the remainder by the Canadian industry. Total demand for Canadian newsprint in 1980 is estimated at 12.4 million tons, 8 percent being used at home, 61 percent by the United States, and the balance being sold in other markets.

In discussing implications of prospective growth, as the voice of an export industry engaged in the development of primary resources, the Canadian Pulp and Paper Association reiterates the simple rules: (1) that "other countries cannot buy from us unless we buy from them," and (2) that costs of production must be kept low if we are to compete in foreign markets. A strong plea is made against subsidizing high-cost secondary industries, whether by protective tariffs or otherwise.

"It is submitted that the best economic policy for Canada is to accept the fact that world demands on Canada will be predominantly for raw materials and basic manufactured commodities, and those are the activities in which we can be most profitably engaged. Secondary industries and services will come naturally and economically to supplement and reinforce the growth of the primary industries but should not be forced, at the expense of our natural resources development."

Finally, a strong plea is made for improvement of the relationship between business and government, a relationship that the Association asserts has been strained by present anti-combines laws and the methods currently used in their administration.

This report should be on the "required reading" list of everyone engaged in the pulp and paper industry and will prove to be a valuable addition to the library of every forester.

J. W. KER
University of British Columbia

Publications of Interest

Career Opportunities in Biology, by Russell B. Stevens, is written specifically for the student who is considering a career in the field of biology. Written for high school students, the 61-page book describes many various jobs dealing with biological subject matter as well as listing employment opportunities and training necessary. The book helps to steer interested students toward more detailed sources of information by suggesting literature references. Lists of scientific organizations and their publications are also included. The book is published by Row, Peterson, and Company, Evanston, Ill.

* * *

In an effort to explain the Multiple-Use Mining Law passed by Congress in July 1955 the U. S. Forest Service has issued a pamphlet, *What is the New Multi-Use Mining Law?* According to the pamphlet the law was passed to prevent unwise use of surface resources on Government-owned land, to help government agencies carry on their work, and to protect the legitimate miner. The pamphlet attempts to answer many questions which arise from the law.

* * *

Perley Spaulding, former forest pathologist at Northeastern Forest Experiment Station, has compiled an annotated list of *Diseases of North American Forest Trees Planted Abroad* in order that more information on diseases which spread from continent to continent will be readily available. In addition to listing and describing diseases the book includes a host index to the diseases, a list of American species planted abroad, and locations of plantings of North American trees. Copies are available at the office of the Superintendent of Documents, U. S. Govt. Print. Off., Washington 25, D. C. at 45¢ each.

* * *

Controlled Burning—Using Fire Wisely is a 12-page bulletin published by the Florida Forest Service. This bulletin, complete with illustrations and photographs, advances the thesis that controlled burning is a carefully devised, carefully executed plan for using fire as a management tool (1) to eliminate heavy undergrowth which presents a wildlife hazard, (2) to facilitate natural reproduction by removing the "rough" prior to seed fall, (3) to kill "Brown Spot" disease in longleaf pine seedlings, and (4) to aid in control of scrub hardwoods.

The bulletin outlines briefly and clearly when controlled burning will help the timberland owner; what to burn; the best conditions for burning; and the proper procedure. Simple charts show, step by step, the ideal method for controlled burning.

Copies of the publication may be had by writing to: Florida Forest Service, Post Office Box 1200, Tallahassee, Fla.

Current Literature

Compiled by MARTHA MEELIG, *Librarian, State University of New York College of Forestry*
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Society of American Foresters
Memphis, Tenn., October 15-17, 1956
Theme: "Forestry Faces Forward"

Schedule of Events

Members, their ladies, and guests who plan to attend the Society's 56th annual meeting are urged to arrive in Memphis on Sunday, October 14, or not later than the morning of Monday, October 15. The opening general session starts on Monday morning.

Because of the full schedule of meetings and social activities, alumni groups are requested to plan their get-togethers during the dinner period (5 p.m. to 7:30 p.m.) on Monday evening, October 15.

General Meeting
Monday, October 15

E. L. Demmon, Chairman

Morning Session

Theme: "Forestry Faces Forward"

1. "Making the Most of the Southern Forest: the Opportunities, the Tasks." Joseph E. McCaffrey, International Paper Company, Mobile, Ala.
2. "Special Horizons in Hardwood Forestry." S. M. Nickey, Jr., Nickey Brothers, Inc., Memphis, Tenn.
3. "Opportunities and Problems in Utilizing Wood Products of the Southern and Southcentral Forests." J. Alfred Hall, U. S. Forest Products Laboratory, Madison, Wis.

Society Affairs Session
Monday, October 15

DeWitt Nelson, President

George A. Garratt, Vice President

Henry Clepper, Executive Secretary

Afternoon Session

1. Report of the President, DeWitt Nelson.
2. Report of the Executive Secretary, Henry Clepper.
3. Report of the Editor of Society Publications, Arthur B. Meyer.
4. Report of the Editor of *Forest Science*, Stephen H. Spurr.
5. Report of the Special Committee on State Registration of Foresters, Julius Kahn, chairman.
6. Report of the Special Committee on Public Relations, C. W. Mattison, chairman.
7. Discussions by the Council and Section delegates:

   Proposed increases in dues (now $6) for Affiliate Members and Associate Members.

   Possible elimination of Bylaw 75 which provides for Associate Members of Sections who are not members of the Society.
8. Other Committee reports.
9. Open forum discussion of Society affairs.

Division of Forest Recreation
Monday, October 15

Donald P. Duncan, Chairman
James P. Gilligan, Vice Chairman
Felix Koziol, Secretary

Evening Session

1. "Mission 66—The National Park System in 1966." Conrad L. Wirth, National Park Service, Washington, D. C.
2. "Problems in Planning for the 1960 Winter Olympics." J. M. Herbert, Division of Recreation and Lands, U. S. Forest Service, Washington, D. C.
3. "Research into the Human Element in Wilderness Use." Marvin Taves and Gregory Stone, Department of Sociology, University of Minnesota, Minneapolis, Minn.
4. "Research Needs in Forest Recreation." Samuel T. Dana, School of Natural Resources, University of Michigan, Ann Arbor, Mich.

Division of Range Management

Monday, October 15

Bert H. Tucker, Chairman
Elbert H. Reid, Vice Chairman
John T. Cassady, Secretary

Evening Session

1. Panel discussion: "The Place and Function of the Division of Range Management in the Society of American Foresters."

Moderator: Lincoln Ellison, Intermountain Forest and Range Experiment Station, Ogden, Utah.

Panel:

DeWitt Nelson, California, Department of Natural Resources, Sacramento, Calif.

Robert S. Campbell, Southern Forest Experiment Station, New Orleans, La.

Milo H. Deming, Bureau of Land Management, U. S. Department of the Interior, Salt Lake City, Utah.

2. "Supplemental Feeding of Cattle on Forest Ranges in the South." John T. Cassady, Southern Forest Experiment Station, Alexandria, La., and Lowell K. Halls, Southeastern Forest Experiment Station, Tifton, Ga.

3. "New Developments in Chemical Brush Control." Hurlon C. Ray, Soil Conservation Service, Fayetteville, Ark.

4. Business Meeting.

Division of Education

Monday, October 15

W. F. McCulloch, Chairman
David M. Smith, Vice Chairman
A. Bigler Crow, Secretary
Wilbur B. DeVall, Program Chairman

Evening Session

Theme: "Regional Planning for Forestry Education in the South"

1. "Objectives of Regional Planning: the Committee at Work." Clarence F. Korstian, School of Forestry, Duke University, Durham, N. C.

2. "Activities of a Regional Council." Winfred L. Godwin, Southern Regional Education Board, Atlanta, Georgia.

3. "Preforestry Training and Transfer within the Region." Alfred D. Folweiler, Texas Forest Service, College Station, Texas.

4. "Recruitment Efforts in the South." Clemens M. Kaufman, School of Forestry, University of Florida, Gainesville, Fla.

5. "Extending Regional Planning to Pulp and Paper Technology." Richard J. Preston, School of Forestry, North Carolina State College, Raleigh, N. C.

GEORGE A. GARRATT
Toastmaster of the Annual Dinner

Division of Private Forestry

Monday, October 15

Arthur W. Nelson, Chairman
William C. MacAdam, Vice Chairman
Sulo V. Sihvonen, Secretary

Evening Session

1. "Let's Cut One for Ourselves! The Outline of a New Idea: a Forestry Company of, by, and for Foresters." Harry Nadler, K-T Forestry Company, Inc., Pineville, Ky.

2. "The Development of Hardwood Forests on Private Lands in the South." John W. Squires, Mississippi Products, Inc., Jackson, Miss.

3. "Natural Areas for Private Forestry." John F. Shanklin, Committee on Natural Areas, Society of American Foresters, Washington, D. C.

4. "The Selection and Training of Foresters for Executive and Managerial Positions."

Comments. George A. Garratt, School of Forestry, Yale University, New Haven, Conn.

Division of Silviculture

Tuesday, October 16

Carl Ostrom, Chairman
Henry I. Baldwin, Vice Chairman
Leon H. Chaiken, Secretary

Morning Session

1. "Opportunities and Problems in the Silviculture of Southern Hardwoods." John A. Putnam, Southern Forest Experiment Station, Stoneville, Miss.

2. "Insects and Diseases in Southern Hardwoods." Robert C. Morris and Richard E. Toole, Southern Forest Experiment Station, Stoneville, Miss.

3. "Variation in Hardwood Growth Rate Attributable to Species and Sites." Thomas C. Nelson, Southeastern Forest Experiment Station, Athens, Ga., and William R. Beaufait, Southern Forest Experiment Station, Stoneville, Miss.

4. "Improvement of Southern Hardwood Stands Through Commerical Harvest or Noncommercial Deadening." J. Scott McWilliams, Union Producing Company, Monroe, La., and J. Sidney McKnight, Southern Forest Experiment Station, Stoneville, Miss.

5. "Silvics and Silviculture of the Most Primitive Hardwoods—Cottonwood and Willow." Carl Maisenhelder, Southern Forest Experiment Station, Stoneville, Miss., and Charles Heavrin, Anderson-Tully Lumber Company, Dyersburg, Tenn.

6. "Future Improvement in Southern Hardwood Quality and Yield Through Genetics." E. G. Wiesehuegel, Tennessee Valley Authority, Knoxville, Tenn.

Afternoon Session

1. "Some Analytical Techniques for Tree Race Studies." Howard R. Kriebel, Department of Forestry, Ohio Agricultural Experiment Station, Wooster, Ohio.

2. "Weekly Diameter Growth of Shortleaf Pine and White Oak as Related to Soil Moisture." William R. Boggess, Dixon Springs Experiment Station, University of Illinois, Robbs, Ill.

3. "Some Factors in Seedling Survival Near the West Margin of the Southern Pine Belt." Edwin R. Ferguson, Southern Forest Experiment Station, Nacogdoches, Tex.

4. "Administrative and Technical Aspects of Establishing Pine Seed Orchards." L. A. Hargreaves, Jr., Georgia Forestry Commission, Atlanta, Ga., and Keith W. Dorman, Southeastern Forest Experiment Station, Macon, Ga.

5. "Prescribed Burning in the Silviculture and Management of Southern Pine-Hardwood and Slash Pine Stands." T. H. Silker, Texas Forest Service, Kirbyville, Tex.

Division of Watershed Management

Tuesday, October 16

Robert E. Dils, Chairman
Howard W. Lull, Vice Chairman
E. A. Johnson, Secretary

Morning Session

1. "Woodlands Part and Foresters' Opportunities in Small Watershed Improvement." George R. Phillips, Soil Conservation Service, Washington, D. C.

2. "Evapo-Transpiration and Water Yields Following Forest Cutting and Natural Regrowth." Jacob Kovner, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

3. "The Chestuee Watershed Project in Lower East Tennessee." Homer A. Smith, Tennessee Valley Authority, Athens, Tenn.

4. "Watershed Management on National Forests of the South." C. Otto Lindh, U. S. Forest Service, Atlanta, Ga.

5. "What's Ahead for Watershed Management Research." V. L. Harper, U. S. Forest Service, Washington, D. C.

6. Business meeting.

Report of the Committee on Hydrologic Training Needs of Foresters. Harold G. Wilm, College of Forestry, Syracuse, N. Y.

Division of Economics and Policy

Tuesday, October 16

Albert C. Worrell, Chairman
Arthur S. Todd, Jr., Vice Chairman
Carl H. Stoltenberg, Secretary

Afternoon Session

1. "Intensive Management Can Be Profitable in the South." R. R. Reynolds, Southern Forest Experiment Station, Crossett, Ark.

2. "Planning Forest Production from the Individual Land Owner's Point of View." Solon L. Barraclough, Ames Plantation, University of Tennessee, Grand Junction, Tenn.

3. "Date Needs, Sources, and Deficiencies for Input-Output Analysis in Forestry." Thomas G. Herndon, School of Forestry, University of Florida, Gainesville, Fla.

4. "Effect of Government Programs on Timber Production in the South." Robert K. Winters, Division of Forest Economics Research, U. S. Forest Service, Washington, D. C.

5. "Some Likely Effects of Closer Utilization on the Supply of Southern Stumpage." Walter C. Anderson, Southeastern Forest Experiment Station, Asheville, N. C.

6. "Stumpage Price Reports as a Stimulus to Timber Growing." Sam Guttenberg, Southern Forest Experiment Station, New Orleans, La.

7. "Stumpage Prices as a Production Guide in Forestry." Carl H. Stoltenberg, Northeastern Forest Experiment Station, Upper Darby, Pa.

Division of Forest Products

Tuesday, October 16

Russell Stadelman, Chairman
Stephen B. Preston, Vice Chairman
Harry E. Troxell, Secretary

Afternoon Session

1. "Utilization—The Key to Better Forestry at Crossett." S. V. Sihvonen, Crossett Forestry Division, Crossett, Ark.

2. "Five-Year Trend in Circular Sawmill Operations in the Tennessee Valley." John W. Lehman, Tennessee Valley Authority, Norris, Tenn.

3. "Research on Hardwoods for Pulp and Paper." Robert J. Seidl, Forest Products Laboratory, Madison, Wis.

4. "Flotation Logging." George C. Lucas, May Brothers, Inc., Garden City, La.

5. "New Developments in the Veneer and Plywood Industry in the South." Walton R. Smith, Southeastern Forest Experiment Station, Asheville, N. C.

Comments. James S. Bethel, North Carolina State College, Raleigh, N. C.

Division of Forest Management

Wednesday, October 17

J. Walter Myers, Chairman
Gerald S. Wheeler, Vice Chairman
B. E. Allen, Secretary

Morning Session

1. "Continuous Forest Inventory as a Guide to Management." George W. Abel, St. Regis Paper Company, Jacksonville, Fla.

Discussion.

2. "Inventory Analysis—First Aid to Hardwood Management." Charles L. Tebbe, U. S. Forest Service, Upper Darby, Pa.

Discussion.

3. "The Consulting Forester's Role in Developing Better Management on Small Tracts." Charles R. Page, Jr., Consulting Forester, Chattanooga, Tenn.

Discussion.

4. "Managing Forests under a Tree Farm Family Program." Richard C. Allen, A. DeWeese Lumber Company, Inc., Philadelphia, Miss.

Discussion.

5. "The Place of Hardwoods in Forest Management for Pulpwood." John W. Johnson, Union Bag & Paper Corporation, Savannah, Ga.

Discussion.

Afternoon Session

1. "Relation of Forest Management to the Insect Problems in the South." R. Joseph Kowal, Southeastern Forest Experiment Station, Asheville, N. C.

Discussion.

2. "The Place of Prescribed Burning in Protecting the Forest." William M. Oettmeier, Superior Pine Products Company, Fargo, Ga.

Discussion.

3. "Forest Fire Insurance as it Affects Forest Management and Fire Control Activities." Monroe F. Greene, Seibels, Bruce & Company, Columbia, S. C.

Discussion.

4. "Forest Fire Research—What it Can Offer Forest Management." V. L. Harper, U. S. Forest Service, Washington, D. C.

Discussion.

5. "Summing Up the Presentations of the Division of Forest Management." John W. Squires, Mississippi Products, Inc., Jackson, Miss.

6. Business session.

Division of Public Relations

Wednesday, October 17

Charles W. Mattison, Chairman
Fred E. Winch, Jr., Vice Chairman
J. Walter Myers, Jr., Secretary

Morning Session

Panel Discussion: The Small Forest Landowner—Keystone and Enigma In Forestry. A discussion of how best to reach this owner through education.

Moderator: Richard J. Preston, School of Forestry, North Carolina State College, Raleigh, N. C.

Panel:

Charles H. Flory, State Commission of Forestry, Columbia, S. C.

Henry J. Malsberger, Southern Pulpwood Conservation Association, Atlanta, Ga.

Herman E. Baggenstoss, *Grundy County Herald*, Tracy City, Tenn.

James W. Craig, Forestry Suppliers, Inc., Jackson, Miss.

Division of Forest-Wildlife Management

Wednesday, October 17

Ralph T. King, Chairman
Avon Denham, Vice Chairman
C. Frank Brockman, Secretary
Howard A. Miller, Program Chairman

Afternoon Session

1. "Coordinated Forestry, Farm and Wildlife Programs for Family Sized Farms of the Coastal Plain of the Deep Southeast." Herbert Stoddard, Sr., Sherwood Plantation, Thomasville, Ga.

Comments. Frank Heyward, Gaylord Container Corporation, Bogalusa, La.

2. "Game as a Product of Intensively Managed Forests." Hubert D. Burke and Robert M. Blair, Southern Forest Experiment Station, New Orleans, La.

Comments. N. W. Sentell, Southern Advance Bag and Paper Division of Robert Gair Company, Hodge, La.

3. "Importance of Southern Bottomland Hardwoods in Wildlife Management." Bryant A. Bateman, School of Forestry, Louisiana State University, Baton Rouge, La.

Comments. Harry Clark, Fisher Lumber Company, Wisner, La.

4. "Effect of Siltation on Trout Streams." Lee B. Tebo, Sr., Wildlife Resources Commission, Raleigh, N. C.

Comments. Thomas C. Nelson, Athens-Macon Research Center, Athens, Ga.

5. "Deer and Turkey in Missouri's Managed Forests." Robert L. Dunkeson, Missouri Conservation Commission, Columbia, Mo.

Comments. Leon Hornkohl, Missouri National Forests, Rolla, Mo.

The Annual Dinner

Wednesday Evening, October 17

George A. Garratt, Toastmaster

Award of the Sir William Schlich Memorial Medal.

Award of the Gifford Pinchot Medal.

First awards by the Society of American Foresters for outstanding achievement in biological research contributing to the advancement of forestry.

Address by Hodding Carter, editor of the *Delta Democrat Times*, Greenville, Miss.

Entertainment.

Social Evening

Tuesday evening, October 16, will be devoted to social activities, centering around "A Night on Beale Street." All members, their ladies, and guests are cordially invited. About this evening, more later.

Ladies' Activities

Sunday, October 14. A special get acquainted tea has been arranged by the Ladies' Committee in the ballroom of the Peabody Hotel, from 4 p.m. to 6 p.m. All members, their ladies, and guests are welcome.

Monday, October 15. A special 35-mile tour of Memphis and the levee by bus, leaving the Peabody Hotel at 11 a.m. The ladies will call at the Nickey-Eason plantation, visit a cotton gin, and see cotton being picked in the field. A barbecue luncheon will be served. Return to the hotel about 4 p.m.

Tuesday, October 16. The ladies forestry forum will be held in the morning with Miss Alma Deane Fuller as the speaker. Forestry motion pictures will be shown. Brunch will be served. There will be special activities during the evening.

Wednesday, October 17. A tour has been arranged, leaving the Peabody Hotel at 11 a.m., to the city hospital center, Brooks' Art Gallery, and other places of interest. Luncheon will be served at the Memphis Country Club, and a fashion show will be featured. Return to the hotel about 3 p.m.

Ladies wishing to participate in all the foregoing activities will be charged a fee of $8 at the time of registration.

Field Trips

Two wood trips and two industry trips are being arranged for October 18 and 19, following the three-day course of meetings and technical sessions. A pair of these trips, composed of one of each type, will be conducted concurrently each day. The pairs are matched as to subject matter and scope.

The woods trips are intended to give as clear a view as possible in a short time of the silvics, actual and potential productivity, and management possibilities and requirements of southern hardwoods. Measured and marked plots will be shown and discussed from all angles in the light of the general situation observed.

The industry trips should convey a fair comprehension of the raw material requirements, manufacturing methods, and types of product of the principal industries using hardwood saw timber and lumber.

In addition, there will be two trips of particular concern to the Division of Watershed Management, but they should be of interest to anyone.

These are not primarily sight seeing trips. Rather they are technical in character. There is no other single locality where so much can be seen and learned regarding hardwood forests, forestry, and wood utilization.

Ladies will be welcome on all trips except the woods trip on Friday. No special clothing is necessary but sturdy walking shoes are desirable.

Thursday, October 18

1. This industry trip will include the plants of:

Memphis Plywood Corporation to see the production of fine rotary face and commercial veneers and construction of hardwood panels.

Chapman and Dewey Lumber Company, principally to see the manufacture of standard hardwood lumber and, from it, boxes and shooks.

E. L. Bruce Company to see the manufacture of a wide variety of hardwood flooring from common oak lumber and furniture parts from other species.

Memphis Furniture Company to see the working up of hardwood lumber into parts and fabrication of furniture; or Norton Manufacturing Company to see the manufacture of tie plugs and specialties from bolts.

2. The woods trip will be to the Shelby Forest; 12,000 acres operated by the Tennessee Park Service northeast of Frayser. Here the general contrast between the upland or loessal bluff and the bottomland forests can be observed with typical variations in each. Good cottonwood, cypress, poplar, oak, and other species will be seen on their respective sites and their possibilities and needs discussed. Also, there has been a remarkable restocking to very promising sapling and pole stands on a great acreage of ruined farm woods and pastures which merits analysis and discussion.

3. The watershed trip will be to inspect the setting and the work of the Yazoo-Little Tallahatchie Flood Control Project, conducted upstream from the big flood control reservoirs in northwestern Mississippi. Here the Forest Service and the Soil Conservation Serv-

ice are applying various techniques and approaches to ameliorate conditions on some 4 million acres of the most spectacularly eroded, formerly prosperous, agricultural territory in North America. One phase of the progress being made was the planting of 40 million pine seedlings.

Friday, October 19

1. The industry trip will include the plants of:

Nickey Brothers, Inc. to see principally production of fine veneers of several kinds and construction of hardwood panels.

Anderson-Tully Company, principally to see the production of standard hardwood lumber and fabrication of automobile and furniture parts, and other items from lumber and rotary veneer.

A flooring producer to see manufacture of hardwood flooring from common grades of standard lumber.

Chas. O. Cox Company to see the manufacture of shuttle blocks, golf heads, striking tool handles, etc.

2. The woods trip will be to a property of the Anderson-Tully Company in the Mississippi bottomlands west of Ripley, Tenn. Premium, large old growth has undergone three and four conservative, marked cuttings with apparent good results. Spot planting of walnut has been successful. The two basic general bottomland forest types are represented in unusually clear contrast in about optimum development.

3. The watershed trip will be made to inspect the Waterways Experiment Station of the Corps of Engineers, U. S. Army at Vicksburg, Miss. This is a world famous installation, doing work on the hydraulics of stream flow. Exact-scale working models of various river and harbor systems, including the entire Mississippi basin under construction over more than 200 acres, are available for inspection. The whole installation, including the work of an elaborately equipped Soils Division, will be shown and discussed. The Vicksburg Infiltration Project of the Southern Forest Experiment Station has been carrying on research for the Corps, bearing on the relation of soil, vegetation, and climatic conditions to mobility of military vehicles.

Transportation

Transportation will be arranged for all trips, but those wishing to use private cars may do so except for the industry tours.

Transportation for the trip to the Yazoo-Little Tallahatchie Watershed will be so arranged that those wishing to return to Memphis may do so and those intending to tour the Waterways Experiment Station may go on down to Vicksburg conveniently. Those wishing to go directly from Memphis to Vicksburg will find either the plane trip or drive convenient; the distance is 225 miles. A bus trip is feasible but tedious. The plane schedule may permit taking in one of the Memphis trips. Those arriving in Vicksburg without local transportation may participate in the arranged facilities there.

Members may obtain further information about the trips and costs of tickets at the time of registration.

Other Places of Interest

Lack of time during an already crowded week precluded combining two other important projects in organized trips. Members who are interested may make personal arrangements for seeing them.

At Grand Junction, Tenn., 50 miles due east of Memphis, the University of Tennessee is conducting pilot scale research into the practical economic aspects of rehabilitation and modernizing a run-down 20,000-acre cotton plantation. Forest management necessarily plays a very important part, involving fundamental problems of land use, credit, etc. Conservative cutting and coordinated utilization and marketing of stumpage, logs, and lumber are being practiced. A sawmill and treating tank are operated on the property. Stand improvement deadening and planting are underway in both hardwood and pine. Solon Baraclough, Ames Plantation, Grand Junction, is in charge and will welcome inquiries.

Between Grand Junction and Memphis, the Wolf River Watershed Association is operating under the Small Watersheds Act on an area of 460,000 acres. The physical situation is much the same as in the Yazoo-Tallahatchie area, but progressive private and local interests are more active, the need for protecting the great federal reservoirs as in Mississippi being absent. Information and directions can be obtained from John R. Aycock, area conservationist, Roon 3, Post Office Building, Memphis.

Hotel Reservations

Those expecting to attend the meeting are urged to arrive in Memphis on Sunday, October 14, or not later than Monday morning, October 15. The first general session starts on Monday morning.

The Peabody Hotel will be the headquarters for the meeting. The Peabody has 625 rooms, but it will not be able to accommodate all those in attendance, hence other hotels are making space available.

However, all members who desire to stay at the headquarters hotel should send their reservations direct to the Peabody. Assignments will be made at, or as near, the desired rate as possible. Requests for rooms will be filled by the Peabody in the order of their receipt until the number of rooms available has been exhausted. The Peabody will then refer reservations that it cannot fill to other cooperating hotels. Early reservations are desirable.

The reservation coupon printed on the next page may be used. Readers who do not want to cut the coupon from their Journals may request reservations by letter by providing all the information listed on the coupon.

As is usual, single rooms may be scarce, hence when possible twin bed rooms should be requested.

Members who prefer hotels other than the Peabody may write them direct, being sure to state that the reservations requested are for the meeting of the Society of American Foresters.

Hotels

Peabody Hotel, 149 Union Avenue, Memphis 1, Tenn. 600 rooms. Single

SOCIETY OF AMERICAN FORESTERS
ANNUAL MEETING
Memphis, Tenn. October 15-17, 1956

....., 1956

Reservations Clerk,
Peabody Hotel,
149 Union Avenue,
Memphis 1, Tenn.

Second Choice Hotel .....

Third Choice Hotel .....

Please make a reservation for the following room accommodations for arrival on October ....., ... a.m., p.m. Departure date, October .....

I understand that accommodations will be provided at the daily rate specified, if available; otherwise the next nearest rate will apply.

..... Single room with bath. Rate, $ .....

..... Double-bed room with bath. Rate, $ .....

..... Twin-bed room with bath. Rate, $ .....

..... Suite (parlor, twin-bed room, and bath). Rate, $ .....

..... Other. (Specify accommodations desired.) .....

..... Rate, $ .....

The above room accommodations are requested for the following persons, in addition to myself. (Print or typewrite names and addresses legibly.)

.....

.....

.....

My name: .....

Street address: .....

City, zone, state: .....

rooms, $5 to $11; double rooms for two, $6.50 to $13; twin-bed rooms, $9 to $15; suites, $19 to $35.

Chisca Hotel, Main and Linden Streets (zone 1). 400 rooms. Single rooms, $4.25 to $7.50; double rooms, $6.25 to $10; twin-bed rooms, $8 to $11.

Claridge Hotel, Main and Adams Streets (zone 4). 400 rooms. Single rooms, $4.50 to $10; double rooms, $7 to $14; twin-bed rooms, $8 to $14.

Gayoso Hotel, 139 Main Street (zone 1). 200 rooms. Single rooms, $5 to $9; double rooms, $7 to $12; twin-bed rooms, $8 to $13; suites, $18 to $30.

King Cotton Hotel, Jefferson at Front Street (zone 1). Single rooms, $4.75 to $8.75; double rooms, $6.75 to $10; twin-bed rooms, $8 to $14.75.

Wm. Len Hotel, Main and Monroe Streets (zone 3). 250 rooms. Single rooms, $3.50 to $5; double rooms, $5 to $6.50; twin-bed rooms, $6.50 to $7.50; suites, $15; and a few large rooms available with four single beds in each for $10.75 for four persons.

Tennessee Hotel, 3rd at Union Avenue. 200 rooms. Single rooms, $2.50 to $6; (air conditioned, $3.50 to $6); double rooms, $4 to $7 (air conditioned, $5 to $7.50); twin-bed rooms, $7 (air conditioned, $7.50).

Motels and Tourist Courts

There are a number of motels and tourist courts in and near Memphis. Those wishing this type of accommodation may obtain a list of them, together with their rates and locations, from the Convention Bureau, Memphis Chamber of Commerce, P. O. Box 224, Memphis, Tenn.

Usually an advance deposit is necessary to hold a reservation at a motel or tourist court.

Committees for the Meeting

Russell Stadelman is general chairman for the meeting. His address is Nickey Brothers, Inc., 2700 Summer Avenue, Memphis 12, Tenn.

Assisting him are the following committees and their personnel.

Program Committee

Philip A. Briegleb is chairman of the Program Committee. His address is Southern Forest Experiment Station, 704 Lowich Building, 2026 St. Charles Avenue, New Orleans 13, La.

The other members of the committee are Glen R. Durrell, Richard Kilbourne, Charles H. Kirk, and Harrod B. Newland.

Committee on Arrangements

Wharton Z. Hawkins is chairman of the Committee on Arrangements. His address is Nickey Brothers, 2700 Summer Avenue, Memphis 12, Tenn.

The following special assignments have been made to the Committee on Arrangements.

Information and Publicity. James O. Artman.

Registration and Welcome. John W. Lehman.

The Annual Dinner. C. F. Grafton.

Field Trips. John A. Putnam, Carl I. Peterson.

Meeting and Conference Rooms. Richard L. Burkhart.

Projection and Amplifying Equipment. Douglas E. Berlin,

Hotel Reservations and Housing. Robert P. Burton, Jr.

Exhibits. William W. May.

Ladies Activities. Mrs. W. Jeter Eason.

Social Night. A. K. Dexter, William T. Hawkins.

SCHOOL BOX SCORE 1956 MEMBERSHIP

School	Student applications received: Sept. 1956	Total 1955	Total 1956
Alabama Polytechnic Institute	0	18	6
University of California	0	17	34
Colorado A & M College	1	9	24
Duke University	0	3	4
University of Florida	1	17	6
University of Georgia	0	28	21
University of Idaho	0	4	18
Iowa State College	0	22	14
Louisiana Polytechnic Institute	1	13	13
Louisiana State University	0	43	13
University of Maine	0	12	13
University of Massachusetts	0	11	13
Michigan State University	0	14	26
University of Michigan	0	21	18
University of Minnestota	0	19	26
University of Missouri	1	26	2
Montana State University	0	25	17
State University of New York	0	23	37
North Carolina State College	0	22	3
Oregon State College	0	38	31
Pennsylvania State University	0	32	19
Purdue University	0	24	16
Utah State Agricultural College	0	12	7
University of Washington	0	28	14
West Virginia University	1	26	5
Yale University	0	16	13
Total	5	523	413

SECTION BOX SCORE 1956 MEMBERSHIP

Section	Applications received: Sept. 1956	Total 1955	Total 1956
Allegheny	2	63	42
Appalachian	1	38	22
Central Rocky Mountain	1	12	26
Central States	0	44	19
Columbia River	0	100	57
Gulf States	4	107	49
Inland Empire	2	10	27
Intermountain	0	18	14
Kentucky-Tennessee	2	9	9
New England	0	50	54
New York	0	33	40
Northern California	1	33	46
Northern Rocky Mountain	1	44	25
Ozark	6	47	18
Puget Sound	0	65	35
Southeastern	1	85	60
Southern California	0	3	1
Southwestern	1	12	1
Upper-Mississippi Valley	0	51	50
Washington	0	2	1
Wisconsin-Michigan	1	40	67
Total	23	866	663

The President's Column

DEWITT NELSON

Between the date of preparation of this column and the date of its appearance stretched the period from the Fourth of July to Labor Day, a period when millions of people annually visit the forests and parks of the nation. In the West the fire season moved into full swing. Protection forces were on duty and "Keep Green" programs were operating in high gear.

Early in July I had the experience of looking over a forest with which I was intimately familiar twenty years ago but had not seen since then. Most of it had been cut over thirty to forty years ago. During the past twenty years a tremendous volume of wood has grown on the land but the brush fields of that day which were caused by forest fires are still brush fields—unproductive forest land. No one who can read the fire history when inspecting such lands can fail to be convinced of the importance of forest fire prevention and effective control. We must spare no effort to reduce man-caused fires and research must be expedited to eliminate lightning-caused fires.

I also visited Montana this summer. There again one can read a record of disasterous forest fires which was indelibly written on the landscape from 1910 until the advent of the "Smokejumpers." Another bit of history in forest protection is being written in that country today—the salvage-logging operations of Engleman spruce for control of the critical bark beetle infestation and the spraying of over one million acres to control the spruce bud worm infestation in Douglas-fir. Here are two great timber species growing together that are threatened; resources, industries, payrolls, and the tax base are at stake. By using modern methods and techniques, and by federal, state, and industrial teamwork these infestations are being controlled.

Timber is a crop and forestry is a long-term form of agriculture. To be sure of that crop in the future we will have a continuing problem of fighting the threats to the forest. Like the farmer, we must never turn our backs on those threats, for regardless of our silvicultural treatment the crop will fail without protection from fire, insects, and disease.

Three courses of action are necessary: (1) a continuous education program to gain an understanding of the problems by all; (2) aggressive research programs to develop effective prevention and control methods; and (3) increasing teamwork between public agencies, owners, and operators in executing prevention and control projects.

DeWitt Nelson

S.A.F. MEMBERSHIP BY SECTIONS, JUNE 30, 1956

Section	Rank	Total	Junior	Member	Fellow	Affiliate	Associate	Student
1. Allegheny	7	666	304	263	4	19	14	62
2. Appalachian	5	726	320	313	5	26	5	57
3. Central Rocky Mountain	16	251	83	128	1	3	4	32
4. Central States	12	422	184	152	1	18	9	58
5. Columbia River	2	1099	534	424	5	57	18	61
6. Gulf States	3	862	376	289	2	104	21	70
7. Inland Empire	20	214	96	82	2	8	6	20
8. Intermountain	18	220	83	108	1	4	1	23
9. Kentucky-Tennessee	19	217	88	110	0	10	9	0
10. New England	9	618	200	264	7	63	14	70
11. New York	11	438	133	216	5	14	16	54
12. Northern California	4	796	337	332	11	51	22	43
13. Northern Rocky Mountain	14	255	100	106	0	13	4	32
14. Ozark	13	387	160	126	1	59	6	35
15. Puget Sound	8	661	288	232	5	75	14	47
16. Southeastern	1	1153	597	385	2	45	21	103
17. Southern California	21	110	50	51	1	5	3	0
18. Southwestern	17	226	93	105	1	25	2	0
19. Upper Mississippi Valley	10	441	155	169	4	21	11	81
20. Washington, D.C.	15	254	36	175	12	3	28	0
21. Wisconsin-Michigan	6	702	263	268	4	51	13	103
No Section Affiliation[1]		200	72	117	2	6	3	0
Corresponding Members		64						
Honorary Members		20						
Total Membership		11,002	4,522	4,415	76	680	244	951

[1]Includes members in U.S. and foreign countries who have requested that they not be designated as members of any Section.

Gulf States Section Elects Officers

Gulf State Section members elected new officers at the May meeting held in Beaumont, Tex.

William M. Palmer of Natchitoches, La., was selected Section chairman. Mr. Palmer is chief forester of Neho Oil Company.

William F. Mann, Jr., of Alexandria, La., who is on the staff of the Alexandria Research Center is vice-chairman. Secretary-treasurer is Hal E. Townsend, Jr., of Natchitoches, La., a member of the faculty of forestry at Northwestern State College.

New Officers of Southwestern Section

Members of the Southwestern Section recently elected Clarence K. Spaulding of Holbrook, Ariz., supervisor of Sitgreaves National Forest, to serve as Section chairman.

Other officers elected are: D. D. Cutler of Alamogordo, N. Mex., vice chairman, and Norman P. Weeden, Albuquerque, N. Mex., secretary-treasurer. Cutler is supervisor of Lincoln National Forest. Weeden is in the regional office of the U. S. Forest Service in Albuquerque.

Forest Practices Development in the United States, 1940-1955

Report of the Committee of Forest Practices, Division of Silviculture, Society of American Foresters, Kenneth P. Davis, *Chairman*.

Ready for distribution in Oct. 1956

Price $1

SOCIETY OF AMERICAN FORESTERS
17th St. at Pennsylvania Ave., N.W.
Washington 6, D. C.

Membership Applications And Advancements

Proposals for admission, advancement, and reinstatements received in the Society office during the month of July are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of October 1, 1956. Communications from voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Allegheny Section

Student Grade

WEST VIRGINIA UNIVERSITY
York, B. W.

Junior Grade

Nelson, J. J., 205 Cedar Ave., Oil City, Pa. Reinstatement.

Member Grade

Connolly, R. A., Tech. Staff, Bell Telephone Lab., Murray Hill, N.J.; Univ. of Maine, B.S.F., 1952; Yale, M.F., (Wood Utilization), 1954. (Junior, 1952).

Kalafus, J., Forester, Pa. Dept. of Forests & Waters, Pottsville, Pa.; Pa. State, B.S.F., 1952. (Junior, 1952).

McNamara, E. F., Research Forester, Pa. Dept. of Forests & Waters, Stroudsburg, Pa.; Pa. State, B.S.F., 1950. (Junior, 1951).

Affiliate Grade

Herman, W. E., Forest Inspector, Pa. Dept. of Forests & Waters, Harrisburg, Pa.

Appalachian Section

Junior Grade

Beal, R. H., 4-C Vetville, Raleigh, N.C.; N.C. State, B.S.F., 1956. (Student, 1954).

Brooks, M. T., 2023 Darden Terrace, Portsmouth, Va.; N.C. State, B.S.F., 1956. (Student, 1954).

Carson, P. B., Box 943, Walterboro, S.C.; N.C. State, B.S.F., 1956. (Student, 1954).

Dozier, W. B., 18 Dixie Dr., Raleigh, N.C.; N.C. State, B.S.F., 1956. (Student, 1954).

Harrell, K. T., Rt. 1, Box 155, Watha, N.C.; N.C. State, B.S.F., 1956. (Student, 1954).

Holmes, R. F., Forester, Va. Div. of Forestry, Charlottesville, Va.; Mich. State, B.S.F., 1947.

Horton, D. W., 210 N. Franklin St., Whiteville, N.C.; N.C. State, B.S.F., 1956. (Student, 1954).

Jones, D. C., 318 Cherry St., Oxford, N.C.; N.C. State, B.S.F., 1956. (Student, 1955).

Kilian, L. A., Box 162, Norlina, N.C.; N.C. State, B.S.F., 1956. (Student, 1954).

Martin, A. L., Box 131, Lake Waccamah, N.C.; N.C. State, B.S.F., 1956. (Student, 1954).

Miller, R. J., Box 151, Manteo, N.C.; N.C. State, B.S.F., 1956. (Student, 1954).

Nelson, H. A., Forester, N.C. Pulp Co., Plymouth, N.C.; Iowa State, B.S.F., 1941. Reinstatement.

Spencer, W. G., 2405 Clark Ave., Raleigh, N.C.; N.C. State, B.S.F., 1956. (Student, 1954).

Webb, J. E., Box 3269, Raleigh, N.C.; N.C. State, B.S.F., 1956. (Student, 1954).

Central Rocky Mountain Section

Student Grade

COLORADO A & M COLLEGE
Weaver, P. N.

Junior Grade

Curtis, W. R., Manitou Expt. Forest, Woodland Park, Colo.; N.C. State, B.S.F., 1956. (Student, 1955).

Member Grade

Berndt, H. W., Forester, Manitou Expt. Forest, Woodland Park, Colo.; Colo. A & M, B.S.F., 1951. (Junior, 1951).

Gause, D. W., Asst. Mgr., Chicago Mill & Lbr. Co., South Fork, Colo.; Colo. A & M, B.S.F., 1949; M.F., 1950. (Junior, 1951).

Central States Section

Member Grade

Curtin, T. W., Research Associate, Univ. of Ill., Urbana, Ill.; Purdue, B.S.F., 1951. (Junior, 1951).

Ferguson, A. C., Dist. Ranger, U.S.F.S., Elizabethtown, Ill.; Univ. of Mo., B.S.F., 1952. (Junior, 1952).
Goodwin, D. K., Consulting Forester, Goodwin & Davis, Indianapolis, Ind.; Purdue, B.S.F., 1950. (Junior, 1951).
Hamann, R. E., Plant Supt., David R. Webb Co., Inc., Edinburg, Ind.; Purdue, B.S.F., 1951. (Junior, 1951).
Lenox, J. T., Asst. Ranger, Ohio Div. of Forestry, Friendship, Ohio; Purdue, B.S.F., 1953. (Junior, 1953).

Columbia River Section

Member Grade

Abraham, D. B., Dist. Ranger, U.S.F.S., Gold Beach, Ore.; Ore. State, B.S.F., 1950. (Junior, 1951).
Adams, G. L., Asst. Dist. Ranger, U.S.F.S., Unity, Ore.; Univ. of Minn., B.S.F., 1953. (Junior, 1953).
Bethlahmy, N., Forester, Pacific NW Forest & Range Expt. Sta., Portland, Ore.; Pa. State, B.S.F., 1939; Yale, M.F., 1940; Cornell, Ph.D., (Soil Science), 1956. Reinstatement.
Bronson, E. W., Forester, U.S.F.S., Hebo, Ore.; State Univ. of N.Y., B.S.F., 1951. (Junior, 1951).
Cowan, W. A., Forester, Bur. of Land Mgmt., Salem, Ore.; State Univ. of N.Y., B.S.F., 1952. (Junior, 1953).
Daub, H. A., Tbr. Mgr., Kingsley Lbr. Co., Portland, Ore.; Univ. of Wash., B.S.F., 1952. (Junior, 1952).
Duysen, G. H., Tbr. Mgr., Kogap Lbr. Industries, Medford, Ore.; Oregon State, B.S.F., 1951. (Junior, 1951).
Hall, F. C., Forester, U.S.F.S., Prineville, Ore.; Purdue, B.S.; Oregon State, M.S., 1956. (Junior, 1951).
Palmer, J. W., Forester, Bur. of Indian Affairs, Klamath Agency, Ore.; State Univ. of N.Y.; B.S.F., 1950. (Junior, 1951).

Gulf States Section

Student Grade

LOUISIANA POLYTECHNIC INSTITUTE

Simmons, B. J.

Junior Grade

Graham, G. F., Dist. Forester, Kirby Lbr. Corp., Woodville, Texas; Mich. State, B.S.F., 1948.

Affiliate Grade

Enghardt, H. G., Forester, La. Forestry Comm., Alexandria, La.

Associate Grade

Duncan, D. A., Rge. Conservationist, Southern Forest Expt. Sta., Alexandria, La.

Inland Empire Section

Junior Grade

Schaertl, R. L., Dist. Forester, Bur. of Land Mgmt., Coeur d'Alene, Idaho; Mont. State, B.S.F., 1939. Reinstatement.

Member Grade

Gardiner, E. T., Asst. Camp Foreman, Potlatch Forests, Inc., Headquarters, Idaho. (Junior, 1949).

Affiliate Grade

Nyberg, T., Check Scaler, Potlatch Forests, Inc., Lewiston, Idaho.

Associate Grade

Jones, M. E., Mgr., Potlatch Forests, Inc., Potlatch, Idaho

Intermountain Section

Member Grade

Fournier, E. A., Dist. Ranger, U.S.F.S., Hailey, Idaho; Univ. of Wash., B.S.F., 1952. (Junior, 1952).

Kentucky-Tennessee Section

Junior Grade

Caldwell, H. T., 303 Hudson St., Maryville, Tenn.; N.C. State, B.S.F., 1956. (Student, 1954).
Mannheim, W. A., Asst. Dist. Forester, Ky. Div. of Forestry, Pineville, Ky.; Univ. of Maine, B.S.F., 1956.

Member Grade

Bean, S. D., Staff Forester, TVA, Clinton, Tenn.; N.C. State, B.S.F., 1953. (Junior, 1953).
Henry, J. R., Forester, U.S.F.S., Memphis, Tenn.; Univ. of Mass., B.S.F., 1949; Yale, M.F., 1953. (Junior, 1953).
Sander, I. L., Forester, U.S.F.S., Berea, Ky.; Univ. of Mo., B.S.F., 1952; M.F., 1952. (Junior, 1952).

Affiliate Grade

Karling, W. J., Forester, Hiwassee Land Co., Etowah, Tenn.; Mich. College of Mining & Tech., B.S., (Forestry), 1953.

New England Section

Junior Grade

Bell, J. T., Racebook Rd., Orange, Conn.; Univ. of Mich., B.S.F., 1956. (Student, 1954).
Rigouard, E. F., 8 Chatham Drive, South Norwalk, Conn.; N.C. State, B.S.F., 1956. (Student, 1954).

Member Grade

Arsenault, R. W., Farm Service Forester, Maine Forest Service, Springvale, Maine; Univ. of Maine, B.S.F., 1950. (Junior, 1951).

New York Section

Junior Grade

Carsten, R. C., R.D. 1, Guilford, N.Y. Reinstatement.

Northern California Section

Affiliate Grade

Trostle, G. C., Entomologist, U.S.F.S., Orinda, Calif.; State College of Wash., B.S., (Forestry), 1948.

Northern Rocky Mountain Section

Junior Grade

Coster, B. A., Asst. Ranger, Bigfork Ranger Sta., Bigfork, Mont.; Mont. State, B.S.F., 1953.

Ozark Section

Student Grade

UNIVERSITY OF MISSOURI

Moose, R. G.

Member Grade

Campbell, D. C., Dist. Forester, Dierks Forests Inc., Eagletown, Okla.; Iowa State, B.S.F., 1951. (Junior, 1951).
Hafner, K. F., Farm Forester, Mo. Cons. Comm., Ironton, Mo.; Univ. of Mo., B.S.F., 1950. (Junior, 1953).

Affiliate Grade

Adams, J. R., Forest Tech., International Paper Co., Sheridan, Ark.; Okla. A & M, B.S., (Forestry), 1956.
Cheatham, H. A., Forester, U.S.F.S., Oklahoma City, Okla.; Okla. A & M, B.S., (Forestry), 1956.
Hopper, G. W., Plainview, Ark.; Okla. A & M., B.S., (Forestry), 1956.
McClure, J. P., Research Forester, Southeastern Forest Expt. Sta., Anadarko, Okla.; Okla. A & M., B.S., (Forestry), 1956.
Young, J. F., Box 296, Wynne Wood, Okla.; Okla. A & M., B.S., (Forestry), 1956.

Southeastern Section

Student Grade

UNIVERSITY OF FLORIDA

Tolar, R. L.

Junior Grade

Sluder, E. R., 120 N. 6th St., Fernandina Beach, Fla.; N.C. State, B.S.F., 1956. (Student, 1954).

Affiliate Grade

Bateman, B. J., Field Asst., International Paper Co., Blountstown, Fla. Reinstatement.

Southwestern Section

Member Grade

Bernard, N. T., Dist. Forest Ranger, U.S.F.S., Lakeside, Ariz.; Colo. A & M, B.S.F., 1950. (Junior, 1953).

Affiliate Grade

Mathews, N. F., Forestry Aide, U.S.F.S., Winslow, Ariz.

Upper-Mississippi Valley Section

Member Grade

Cooper, O. Z., Asst. Forester, Minn. & Ont. Paper Co., International Falls, Minn.; Purdue, B.S.F., 1949. (Junior, 1952).

Wisconsin-Michigan Section

Member Grade

Davey, C. B., Soils Specialist, U.S. Army, Madison, Wis.; State Univ. of N.Y., B.S.F., 1950; Univ. of Wis., M.S., (Forest Soils), 1952; Ph.D., (Forest Soils), 1955. (Junior, 1951).
Diez, C. M., Forester, Marathon Corp., Mercer, Wis.; Univ. of Mich., B.S.F., 1951. (Junior, 1951).
Kuhne, E. R., President, Forestry Assoc. Inc., Hart, Mich.; Univ. of Mich., B.S., (Science), 1935; M.S., (Forestry & Cons.), 1936. (Junior, 1952).
Lucas, H. A., Forester, U.S.F.S., White Cloud, Mich.; Ore. State, B.S.F., 1933. Reinstatement.

Affiliate Grade

Hallisy, R. J., Forester, Wis. Cons. Dept., Tomahawk, Wis.; Mich. College of Mining & Tech., B.S., (Forestry), 1952.

Foreign

Corresponding Grade

D'Silva, D. W., Asst. Conservator of Forests, Divisional Forest Officer, El Cayo, British Honduras.
Pinheiro, J. V., Tech. Asst., Forestry Service Paulista Railroad Co., Sao Paulo, Brazil; Univ. of Idaho, M.F., 1956.

Forestry News

Seven Professional Groups Cooperating in I.C.A. Program

More than 31,000 foreign technical specialists in various fields have received training in this country under programs sponsored by the International Cooperation Administration and its predecessor agencies. I.C.A. has subsequently put into effect a plan of cooperation with American professional associations and societies to help these specialists keep in contact with their counterparts in the U. S. Participation by the S.A.F. was approved by the Council at its February, 1956 meeting. (Reported in the April JOURNAL OF FORESTRY.)

The I.C.A. has announced that six professional societies in addition to the S.A.F. are also cooperating in this program. They are the American Public Health Association, American Nurses' Association, American Home Economics Association, American Statistical Association, American Society for Public Administration, and the Soil Conservation Society of America. Other associations and societies are expected to participate eventually.

Under this cooperative program with I.C.A. overseas foresters who have participated in training programs will receive the JOURNAL OF FORESTRY under a form of payment in which the subscriber would pay a portion of the subscription price and I.C.A. would pay the balance. As provided in the Constitution and Bylaws of the Society such subscribers would become Corresponding Members.

I.U.P.N. Changes Name

The name of the International Union for the Protection of Nature was changed in July. It will be replaced by "International Union for Conservation of Nature and Natural Resources." In the United States, and possibly elsewhere, this will be shortened to the "International Union for Conservation" or I.U.C.

By majority vote of its General Assembly, which met in Edinburgh, Scotland, June 20-28, I.U.P.N. revised the name it has held since its creation in 1948. The formal proposal to the Assembly resulted from strong feeling that the Union's position was handicapped by the term, "protection of nature."

I.U.C. is composed of 225 organizations and agencies in 46 nations, united for the conservation and wise use of renewable natural resources. Implications of the original name were not in keeping with these aims according to delegates at the Edinburgh Assembly. They felt that "protection of nature" suggested a sentimental attitude: an attempt to defend nature *against* man, rather than to conserve, *for* man, and wisely use, the world's natural resources. This latter view has been the Union's since its inception.

"International Union for Conservation of Nature and Natural Resources" was chosen as appropriate and adaptable to many language requirements.

Forest History Foundation Expands Program

Plans for an expanded research program and a new counseling service highlighted the second annual meeting of the Forest History Foundation, Inc., in St. Paul, Minnesota.

The nonprofit educational organization, founded in 1955, will launch a full scale program to collect, preserve and disseminate the history of the forests and forest industries in North America.

Elwood R. Maunder, the foundation's director, reports that "financial support of the Forest History Foundation's work last year increased from $21,375 to $33,640 and the number of sponsors to 135. This encouraged the Board of Directors to approve plans for an enlarged program in 1956-1957."

The expansion program is two-fold, Maunder explains. One phase establishes a new service of specialized counseling for all forest-related groups and industries on the preparation of business and institutional histories, record inventories, and oral history collections.

An enlarged research operation on the various phases of North American forest and forestry history makes up the second phase of the foundation's expansion program. Research will be undertaken by professional historians working with renowned foresters and guided by small advisory committees of other prominent historians and foresters. The foundation will select and appoint these persons from the area under study.

Maunder reports the foundation plans to launch the first of a series of such research projects in western United States and Canada.

This particular project, he states, will involve a two-year study of the history of fire control in the region at an estimated cost of from $25,000 to $30,000.

The Foundation's Board of Directors has moved to make the western research project a memorial to the late Colonel William B. Greeley. Colonel Greeley served on the Foundation's Board until his death last year and took a leading part in organizing state and provincial committees on forest history in Washington, Oregon, and British Columbia.

Board action also included approval of a $52,514 general operating budget for the 1956-1957 fiscal year.

Its June 29 session marked the first board meeting held in the Forest History Foundation's new offices at 2706 W. 7th Blvd., St. Paul.

Dr. Frank H. Kaufert, director of the School of Forestry, University of Minnesota, was re-elected president; F. K. Weyerhaeuser, president of Weyerhaeuser Sales Company, St. Paul, was renamed first vice-president; and Maunder, director of the foundation and secretary of the board.

The newly elected second vice-president is George L. Drake, forestry consultant, Tacoma, Wash. Other officers elected were Clarence G. Frame, cashier of the First National Bank, St. Paul, treasurer; Charles J. McGough, secretary of the Rock Island Lumber Co., St. Paul, assistant treasurer; and Miss Clodaugh Neiderheiser, the foundation's research associate, assistant secretary.

Private & Industrial

Agriculturists Honor E. O. Ehrhart

E. O. Ehrhart, president of the Armstrong Forest Co., has been awarded an honorary certificate of membership in Gamma Sigma Delta, agricultural honor society. The firm is the woodlands division of New York & Pennsylvania Co., book paper man-

No. 23 of a series featuring forestry practices, projects and products

Missouri

Forestry Through Cooperation

Missouri—"The Gateway to the West" earned this title literally, as it marked the termini of the Santa Fe and Oregon Trails. It was not until the early part of the century that Missouri's 31 million acres of fine hardwoods and shortleaf pine timber stands caught the attention of the lumber interests.

It was about this time that the end was in sight for the so called never ending supply of Lake States timber, and the industry turned to the south stopping enroute long enough to liquidate all the best stands of timber in Missouri. At one time, the small town of Grandin supported what was then called the "Largest Sawmill in the World."

The Show-Me State ran true to form with its forest problems, and a positive forestry program did not materialize until 1936. At that time the people of the State, by popular vote, adopted an amendment to the Constitution that has been considered nationally as a shining example of sound conservation.

A unique feature resulting from this amendment is the coordinated tie-in of forestry with all other Divisions of the Missouri Conservation Commission.

Missouri's forestry program gained its present stature through an aggressive policy of cooperation. Seedling trees produced in the Forestry Division Nurseries are distributed through the cooperation of the State Extension Forester and the County Extension Agents.

Financial support for forest research is given to the University of Missouri and the U. S. Forest Service. Technical personnel are made available to the Soil Conservation Service on the Small Watershed Program. Full scale participation is made with the several Forest Service cooperative programs. Active assistance is rendered to the Agriculture Conservation Program in all of the forestry practices set up in their handbook.

With the exception of the land inside the Missouri National Forests, the Forestry Division of the Conservation Commission has the job of fire protection, and full development of all the State's forest resources. Of special note is the Forest Crop Land Program in which forest landowners get partial relief of taxes with additional assistance in timber management and trespass. Some 300,000 acres of woodlands are now pledged to this program. Missouri's forestry program still has a long way to go, but the Conservation Commission's 12 Farm Foresters and 10 District Foresters are dedicated to increasing the productivity of all state and private forest lands in Missouri.

M. G. HOYER, ASSISTANT STATE FORESTER, MISSOURI CONSERVATION COMMISSION—*contribution to this series does not necessarily constitute endorsement of Southern Glo products.*

Control, an important function of the forester, is likewise an important factor in producing SOUTHERN GLO tree marking paints.—Ingredient quality and quantity, mixing, processing . . . even packaging,—so vital is the control of these to SOUTHERN GLO performance that we produce every gallon in our own plants. You see, we're pretty proud of the satisfaction these paints give users,—and we recognize that their record entails a responsibility. So, wherever you get SOUTHERN GLO . . . from your forestry supply dealer, from the Sumter (S.C.) plant, or from our recently opened plant in New Orleans . . . you get the same stay-mixed convenience, the same high-coverage, high-visibility, the same non-clogging action,—order after order.

SOUTHERN COATINGS AND CHEMICAL COMPANY. Dept. 2. Sumter, South Carolina

ufacturers.

The certificate was presented recently at an initiation banquet held by the agricultural group to mark the beginning of its second fifty years of service to the profession. The banquet was given at University Park, Pa., campus of Pennsylvania State University. Ehrhart is a graduate of Penn State's School of Forestry and is the first forester to be honored by a membership in Gamma Sigma Delta.

Tree Farm Program Continues Growth

The American Tree Farm System gained nearly 2 million acres during the first half of 1956, according to midyear figures announced by C. A. Gillett, managing director of American Forest Products Industries, the national sponsor.

Certified Tree Farm acreage in 43 participating states now totals 39,587,554 acres as compared to 37,838,910 acres last Jan. 1 and 35,396,564 on July 1, a year ago.

Georgia, with 3,795,743 acres enrolled, retains national leadership, followed closely by Florida with 3,603,014 acres; Alabama, 3,558,242 acres; Oregon, 3,524,931 acres; Texas, 3,389,881 acres; Arkansas, 3,372,423 acres; and Washington, 3,322,994 acres.

Mississippi leads in the number of certified Tree Farms: 910. Texas is second with 831, and Alabama third with 663.

Three more states launched the Tree Farm program during the first half of this year—Vermont, Connecticut and New York.

The industry sponsored tree farm program is now 15 years old.

R. N. Hoskins Promotion Announced

Robert N. Hoskins, industrial forester for the Seaboard Air Line Railroad since 1945, has been promoted to general forestry agent for the company, according to an announcement by Warren T. White, assistant vice president in charge of industrial development.

Hoskins, who will continue to have his headquarters in Norfolk, is widely known in forestry circles throughout the territory served by the Seaboard. He is a member of a number of state forestry associations, and is credited with establishing the first regional farm youth forestry program in the South. He has been cited by a number of organizations, including the national Junior Chamber of Commerce for his work as conservation chairman. The Norfolk Junior Chamber of Commerce also has given him a special certificate of merit for his contributions to human welfare. In 1947 he was given the degree of Honorary American Farmer by the national association of Future Farmers of America. He holds the Iowa State College alumni merit award for 1954, and the American Forestry Association Certificate of Merit given in 1956.

Within the past few months Hoskins co-authored a textbook entitled *Forestry in the South* which already has been officially approved by five Southeastern states for classroom work.

Forestry Association Executives To Meet in Richmond, Va.

On September 28-29 the Council of Forestry Association Executives will hold its eighth annual conference in Richmond, Va.

Chief topic for discussion during the two-day conference will be Virginia Forests, Inc., with W. E. Cooper, executive secretary, leading the main discussion of the organization's details.

Present officers of the Council are: chairman, M. N. Taylor, of Merrill, Wis.; vice-chairman, W. E. Cooper, of Richmond, Va., and secretary, A. M. Williams, of Boston, Mass.

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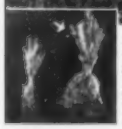

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NORWAY SPRUCE—Fast growing
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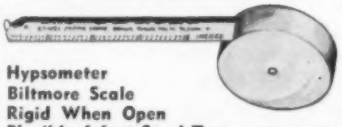
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McCulloch Motors Contributes Aid To Forest Marketing Program

McCulloch Motors Corporation is giving financial support to a new study program designed by the North Carolina State College to help forest owners earn more dollars from their timber through better marketing practices.

The program, headed by a timber marketing expert of the faculty of North Carolina State College, will deal with information on present market outlets for timber and timber products, product specification, grading systems, measurement methods, demand trends, and pricing factors.

In addition to the funds provided for a three-year period by McCulloch Motors, money will also be made available through the Agricultural Marketing Administration.

Supervises Sales for Crandon Paper Mills

Oswald K. Krogfoss has been appointed sales manager for Crandon Paper Mills, Inc. of Chicago. He will supervise sales of paperboard for the company throughout the United States.

Krogfoss is a 1935 forestry graduate of the University of Minnesota; later served in the U. S. Forest Service, the Tariff Commission and the Department of Commerce. For the past 3½ years he has been a board salesman for the Union Bag and Paper Corporation.

J. B. Smith Joins Weyerhaeuser Information Department

Jerome B. Smith joined Weyerhaeuser Timber Company's public information department in Tacoma, Wash. in July as public information representative for Washington state.

For the past two years, Smith has been public information officer at Air Training Command Headquarters, Scott Air Force Base, Ill. Previously, he was associate editor of *American Lumberman* and *Home Maintenance and Improvement* magazines in Chicago, and held a trainee position with R. S. Bacon Veneer Company also in Chicago.

Smith graduated in 1953 from Iowa State College, majoring in forestry and journalism.

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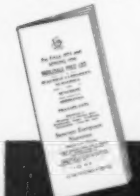

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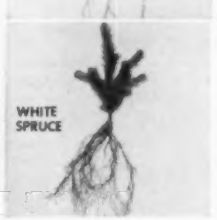
WHITE SPRUCE

Education

A.P.I. Celebrates 10th Year of Professional Training

The forestry department of Alabama Polytechnic Institute Agricultural Experiment Station and School of Agriculture, Auburn, celebrated the tenth anniversary of the establishment of its professional forestry curriculum on July 23.

A Special Forestry Day, reports W. B. DeVall, Forestry Department head, was attended by state and forestry leaders who endorsed the measure to organize the department. L. M. Ware, head of horticulture who headed forestry when it was a part of the horticulture department, was a special guest.

A 10-year progress report was made by forestry department staff members. Professor Ware reviewed the history of forestry research and instruction at API prior to 1946.

Auburn's first forestry course was offered as early as 1897 and the forestry research program of the Experiment Station was started in 1926. For many years the joint department of horticulture and forestry was operated. After legislation providing for a separate forestry department was adopted in 1945, the first professional

forestry curriculum was offered in 1946.

A separate forestry department was organized in 1947. R. H. Westveld, presently head of the School of Forestry at the University of Missouri, was the department's first head. He was succeeded by T. D. Stevens, now at Michigan State, and in 1951 by Professor DeVall.

The forestry department was accredited by the Society of American Foresters in 1951. Located in a small, temporary structure in 1947, forestry was moved into its new, two-story brick building in 1948.

Zobel Heads New Tree Improvement Program at North Carolina

The School of Forestry at North Carolina State College has begun a five-year regional program in forest genetics.

In reporting this, Dr. Richard J. Preston, dean of the college's School of Forestry, said 11 pulp and paper companies and the N. C. Agricultural Experiment Station have joined the School of Forestry in undertaking the project, which is known as the cooperative Forest Tree Improvement Program.

The region-wide study was launched with a $26,500 budget including

BRUCE J. ZOBEL

$10,000 in agricultural Experiment Station funds and $16,500 invested by the 11 supporting pulp and paper firms. Additional companies also are expected to take part.

At the end of the five-year period results will be reviewed. Continuation of the project after that time, Dean Preston said, will depend upon the achievements made.

In its first stages, the program will cover the states of North Carolina, South Carolina, Virginia, Georgia, and Tennessee and will be expanded to other areas in the Southeast as the work progresses.

Dr. Bruce J. Zobel, silviculturist with the Texas Forest Service at Texas A & M College, has been appointed to head the project.

Zobel will be assisted by Robert L. McElwee, who was previously forest management specialist with the Gaylord Container Corporation.

Pulp and paper companies, each of which has invested $1,500 to get the work started, are the Camp Manufacturing Company of Franklin, Va.; Gair Woodlands Corporation, Savannah, Ga.; Champion Paper and Fibre Company, Canton, N. C.; Union Bag and Paper Corporation, Savannah, Ga.; West Virginia Pulp and Paper Company, Georgetown, S. C.; Bowaters Southern Paper Corporation, Calhoun, Tenn.; North Carolina Pulp Company, Plymouth, N. C.; Chesapeake Corporation of Virginia, West Point, Va.; Reigel Paper Corporation, Bolton, N. C.; International Paper Company, Georgetown, S. C.; and Halifax Paper Company, Roanoke Rapids, N. C.

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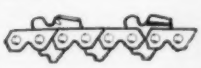

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University of New Brunswick Honors J. W. B. Sisam

J. W. B. Sisam, dean of the Faculty of Forestry, University of Toronto, in recognition for his work in forestry, has been awarded the honorary degree of doctor of science by the University of New Brunswick.

Dean Sisam is currently president of the Canadian Institute of Forestry. He is a Member of the Society of American Foresters and a former associate editor of the JOURNAL OF FORESTRY.

Yale Industrial Seminars Announced

The Yale University School of Forestry will join with the University of California next year to sponsor an industrial forestry seminar in Berkeley, California.

The California meeting to be held in January, 1957, will be one of a series of three seminars to be held next year by the Yale Forestry School for top executives in industrial forestry.

The series was started at Yale last year in New Haven and attended by forestry executives from all parts of the country. The seminars were found to be so successful that they will be continued in 1956-57 with the first and the third to be held at Yale and the second one, in January, to be in California, to accommodate West Coast executives.

Ernest T. F. Wohlenberg, professor of industrial forestry at Yale, is director of the seminars. He announced that the first seminar, in New Haven, will run from October 22 through November 2, 1956.

The second seminar will be at the University of California with the exact dates in January 1957 to be announced later. This seminar will be under the joint auspices of the Yale and California forestry schools. And the third seminar will be here at Yale in March 1957.

The program for the 1956-57 series will conform in general to that for the three sessions previously held in New Haven. It will cover such subjects as forest inventories and stand structure studies; business organization in the forest industries; income taxes in relation to operating costs; public relations in forestry; integration, research, and product development in the forest industries; labor relations

and collective bargaining; and the role of forest genetics in forestry.

The combined Proceedings for the second and third Seminars, held in New Haven on November 7-18, 1955 and January 23-February 3, 1956, are now ready for distribution. The 458-page mimeographed proceedings, which combine the seminar leaders' presentations and the subsequent discussions, are available for sale, at $6.00 per copy. Orders should be placed through the Yale School of Forestry, 205 Prospect Street, New Haven.

Koloman Lehotsky Heads Clemson Forestry Department

Dr. Koloman Lehotsky became the first head of the newly created Forestry Department of the Clemson Agricultural College, Clemson, South Carolina, on July 1, 1956.

Dr. Lehotsky was born in Spisska Nova Ves, Czechoslovakia, February 18, 1906. He received his professional degree in forestry from Prague in 1928 and his doctorate from the University of Michigan in 1934. He also became a citizen of the United States in 1934. He was Junior forester with the Soil Conservation Service, 1934-1935; assistant forester, 1935; associate forester, Section Watershed and Hydraulic Studies, 1935-1937; professor of forestry, Escola Superior de Agr. e Vet, 1937-1938; area forester, Soil Conservation Service, 1938-1942; U. S. Army 1942-1944; and forestry specialist, U. S. Department of Agriculture, 1944-1947. He came to Clemson College as associate professor of forestry in 1947. Since that time, he has been in charge of the preforestry and farm forestry courses that were offered under the botany department. He received his full professorship in 1955.

Dr. Lehotsky is a member of the Society of American Foresters and the South Carolina Academy of Science. His chief specialties are in silvics and dendrology.

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Public

C. B. Marlin Appointed Mississippi State Forester

Clifton B. Marlin was appointed State Forester on July 17 by the Mississippi Forestry Commission at a special meeting held in the office of Governor J. P. Coleman, Chairman of the Commission.

Marlin is a native Mississippian, is 35 years of age, holds a degree in agricultural economics from Mississippi State College and a Masters in Forestry from Duke University. He formerly taught forestry at Mississippi State College. He has served as forest management director for the Commission during the past four years. During that time he has supervised the Commission's program of forestry advice and assistance to private landowners, timber management on state-owned lands, contract management of sixteenth section school lands for boards of supervisors, enforcement of forest harvesting laws, operation of forest tree seedling nurseries, and coordination of forestry efforts with those of federal agencies, other state departments, and consulting and industrial foresters.

Marlin, while an infantry Lieutenant, and a member of the First Infantry Division in France, Belgium, and Germany, was seriously wounded on November 18, 1944. He was subsequently awarded the Purple Heart, the Bronze Star, the Combat Infantryman's Badge, and two Bronze Campaign Stars. He left the service as a Captain in 1947.

East Gulfcoast and Alexandria Research Center Leaders Announced

John T. Cassady, leader of the Alexandria, La., U. S. Forest Service research center, Southern Forest Experiment Station, has been appointed leader of the Station's East Gulfcoast center at Marianna, Fla. William F. Mann, who has been at the Alexandria center since 1951 will succeed Cassady.

Cassady, a 1932 graduate of the University of Arizona, holds a master's degree in ecology from that school. He is a member of both the S.A.F. and the American Society of Range Management. Prior to World War II he conducted forest and range research in the West. He served with the Air Technical Training Command and the Ninth Air Force from 1941 to 1946.

Mann was graduated from Pennsyl-

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WILLIAM F. MANN

vania State University in 1937. In 1945, following three years' service in the Navy, he became superintendent of the Harrison Experimental Forest in southern Mississippi. From 1949 to 1951 he conducted research on the

JOHN T. CASSADY

Crossett Experimental Forest in southern Arkansas. He has been project leader of forest management research at Alexandria since 1951.

Appointment of J. M. Owens as Acting Deputy Director, B.D.S.A. Forest Products Division

The appointment of James M. Owens as acting deputy director of the Forest Products Division of the Business and Defense Services Administration, U. S. Department of Commerce, has been announced.

Owens succeeds Donald G. Shook who has returned to private industry after serving as deputy director of the Division.

Prior to this appointment, Owens had served as assistant director of the Division since October 1953, coming to B.D.S.A. at that time from the position of chief, industrial engineering, Office of the Quartermaster General. He recently completed a 10-month course at the Industrial College of the Armed Forces, in which he received special training in problems of industrial mobilization for defense.

Owens graduated from the N. Y. State University College of Forestry in 1938 with the degree of B.S. in Forest Products Engineering. From 1939 to 1942 he served as assistant superintendent and superintendent of the U. S. Gypsum Company's fabrication plant. He enlisted as a private in the Air Corps in 1942, remaining in the service until 1945, when he received his honorable discharge as a Captain.

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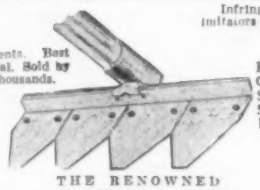
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Colonel E. Morgan Pryse Retires

Col. E. Morgan Pryse, Washington, D. C., former Secretary-Treasurer of the S. A. F. (1930-1931) has retired after 39 years of civil and military services.

COL. E. MORGAN PRYSE

After World War I he entered the U. S. Indian Service serving in the western states and in the Washington, D. C. office. In 1933 he organized and headed up the Bureau's Highway Department for eight years. Subsequent to World War II he was director of the Indian Bureau Regional Offices in the Pacific Northwest States and later the Great Lakes Office.

Col. Pryse joined the 10th Engineer Regiment (Forestry) as a private in 1917 and served overseas for two years, returning from France as a 2nd Lieut. of Engineers. He was called to active duty in 1940.. He was Engineer for the 9th U. S. Air Force in Egypt and the Holy Land, later serving as Assistant Chief of Staff of the 9th U. S. Army Engineer Command and as Commanding Officer of the 924th Engineer Regiment. He participated in seven major battles and was awarded decorations by the United States, Belgian ,and French governments.

He attended the University of Montana, the Universite' de Bescanon, France, and holds degrees of B.S., A.M., and LL.B. from Oregon State College, American University, and George Washington University.

Three Minnesota Foresters Retire

Three men, whose years spent with the Minnesota Forest Service total to 125, have retired from the organization.

J. C. Gannaway retired on July 1st. He began his forestry career as a forest patrolman at the Hibbing office on April 22, 1919. The following month he was transferred to Orr, and in 1926

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to Hill City as district ranger (equivalent to area supervisor). In 1928 his headquarters became Baudette, and then in 1932 he was transferred to the Brainerd district. In 1934 he became assistant in charge of state timber with headquarters in St. Paul, the position he held before his retirement. In this position he was responsible for the sale of timber from approximately five million acres of state owned land. Following his retirement from the State Forest Service, he will be associated with the Timber Producers Association in Duluth.

A. F. Oppel, who retired July 12, joined the Forest Service, St. Paul office, May 1, 1912, following his graduation from the School of Forestry, University of Minnesota. At that time the state organization was in its infancy. From 1912 until 1932 he held the positions of patrolman and inspector, silviculturist, assistant in charge of state forests, and assistant state forester. From 1932 until 1937 he was deputy director of the Division of Forestry. On December 1, 1937, he was made forester in charge of special projects. He served in that capacity until retiring.

A. E. Pimley retired on July 30. He began his state forestry career on April 1, 1912, as a patrolman at Park Rapids, and four years later became district ranger. In 1920 he was transferred to the St. Paul headquarters as assistant in fire prevention. He has continuously since that time been in charge of the administration of Minnesota's forest fire protection work.

H. O. Robe Heads Operations in Northern Region

Harvey O. Robe has been appointed assistant regional forester in charge of the Division of Operation of the Northern Region of the U. S. Forest Service, Missoula, Mont.

For the past three years he has been serving in the Washington office of the Forest Service in the Division of Operation, specializing in administration, management, budget controls, and organization functions.

Robe succeeds James C. Iler who was transferred to the Office of the Chief, Washington, D. C.

Lane Heads Management Research at Northeast Station, Succeeded by Merz

Richard D. Lane, research center leader at the Carbondale (Illinois) center of the Central States Forest

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INDEX TO ADVERTISERS

	Page
Atkinson, S. Gayley	619
Banzhaf & Co., George	618
Bartlett Mfg. Co.	623
Belanger & Bourget	618
Bozett, Wm. J.	619
Caterpillar Tractor	3rd cover
Clark, Thomas G.	619
Cranston, Keith	618
Eastman, Jr., William	619
Feehheimer Bros. Co.	616
Forest Seeds of Calif.	622
Forestry Suppliers	614, 619
Guiney, R.	622
Hale Fire Pump	620
Hall, Albert G.	619
Hall, Jack M.	619
Homelite Corp.	back cover
Keene Forestry Assoc.	622
Kurfew, Inc.	616
Lemieux, Frank J.	619
Lind Co., A. L.	622
Lowther Co., Harry A.	622
Lufkin Rule Co.	615
Mall Tool Co.	617
Marden Mfg. Co.	621
Melin Meterological Service	620
Midvale Chemical	620
Musser Forests	614
Nelson Co.	623
Northeast Forest Service	619
Northern Tree Co.	619
Oregon Saw Chain	615
Panama Pump Co.	622
Pond & Moyer	619
Prentiss & Carlisle, Inc.	619
Price, William H.	619
Rich Fire Tool	622
Ryker, Inc., Harrison C.	622
Sandvik Saw & Tool	615
Schultz, C. D.	618
Sebrell Corp., J. B.	620
Sewall Co., J. W.	618
Silva, Inc.	620
Smith Co., D. B.	2nd cover
Southern Coatings	613
Southern Seed Co.	620
Stock, John W.	619
Sunecrest Evergreen	616
Timber Mgmt. Service	619
Tree Farm Mgmt. Service	619
Walpole Co.	623
Western Fire Equipment	614
Weyerhaeuser Timber Co.	562

Experiment Station, has been transferred to the Northeast Forest Experiment Station, Upper Darby, Pa., as chief of the Division of Forest Management Research. Lane has been leader at Carbondale since 1949.

Robert W. Merz, forester in charge of the Athens (Ohio) Research Center of the Station will transfer to Carbondale to fill Lane's vacancy.

Lane received his forestry training at Iowa State College, Merz at the University of Minnesota.

Interior and Agriculture Improve Land Exchange in Oregon

The Secretaries of Agriculture and Interior in June took a major step in untangling the complicated federal land pattern in Oregon through the signing of an order exchanging certain lands under their administration. This order carries out the provisions of Public Law 426 of June 24, 1954, which was sponsored in Congress by then Senator Guy Cordon and Representative Harris Ellsworth of Oregon.

The lands exchanged have formed a checkerboard pattern with the Forest Service administering the even number sections and the Bureau of Land Management, the odd. The Cordon-Ellsworth law directed this exchange so that land administered by the Forest Service of the Department of Agriculture will be consolidated in blocks in certain areas and those administered by the Bureau of Land Management of the Department of the Interior consolidated in other areas.

Involved in the exchange are 241,137 acres of national forest lands and 242,734 acres of revested Oregon and California Railroad grant lands in 13 counties of western Oregon.

Products

New Paint "Hammer" Marks Logs

A new log marking paint and paint hammer have been developed by the Nelson Company of Iron Mountain, Mich. In recent field tests by a large pulp company, the Nel-Spot Paint Hammer produced 20,000 marks to a gallon of paint. This compared to 4,500 marks to a gallon which the same company averaged with conventional dip-drip-and-splash methods. The same tests showed that due to the continuous marking possible with the new Nelson Paint Hammer, a rate of 100 logs marked per minute was easy. Twenty-five per minute is the norm with the waste motion involved in constant stops to dip paint and move a paint bucket.

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously, the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

Position Wanted

Research Forester. Age 55. Two years at Dickinson College. B.S.F. 1926. M.F. at Cornell 1928. One year teaching forestry. 28 years experience in forest research—handling hundreds of permanent study plots covering many phases of silviculture and forest management, a first-class arboretum, writing bulletins and articles. Married, 4 children, 2 at home. Prefer Eastern States but would consider elsewhere.
Box P, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S.F., 1949. Two years experience with state forest service in management, fire protection, and public relations. Five years experience with large land holding company doing supervisory work in forest management, farming and road construction. Desire opportunity in wood procurement or sales. Age 32, Reserve Naval Officer; married; two children.
Box Q, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, Graduate, school for Forestry and Rural Engineering, Arnhem, Holland. Passed civil service exam. for Asst. State Forester in U.S. 15 years of experience with leading organization in Europe; forest management, public relations; rural engineering; etc. 8 years experience in U.S. 4 years in own business. Interested in position where I can most effectively use training.
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This D9 heads a line-up including a D8, D7 and D6 building 18 miles of road for Oliver & Oliver Logging Company in mountainous country near Thompson Falls, Montana. The road will tap at least 50,000,000 bd. ft. of timber on U. S. Forest Service land.

CAT* D9 TRACTOR WITH NO. 9A BULLDOZER PIONEERS ½ MILE OF 14-FOOT ROAD PER 8-HOUR DAY IN LOLO AND KANIKSU NATIONAL FOREST

When you're faced with a tough road building job, you'll find it pays in time and money saved to use a giant—the rugged 58,725-lb. Cat D9 Tractor. That's what the Oliver & Oliver Logging Company is doing on this show in the Lolo and Kaniksu National Forest near Thompson Falls, Montana. This company has a contract to construct 18 miles of main haul road from Graves Creek to Vermillion River, with grades up to 5% on one side of a 6200-foot divide and up to 9% on the other side. In rocky, stumpy going, the D9 is pioneering ½ mile of 14-foot road per 8-hour day. Here's a report from co-owner John W. Oliver:

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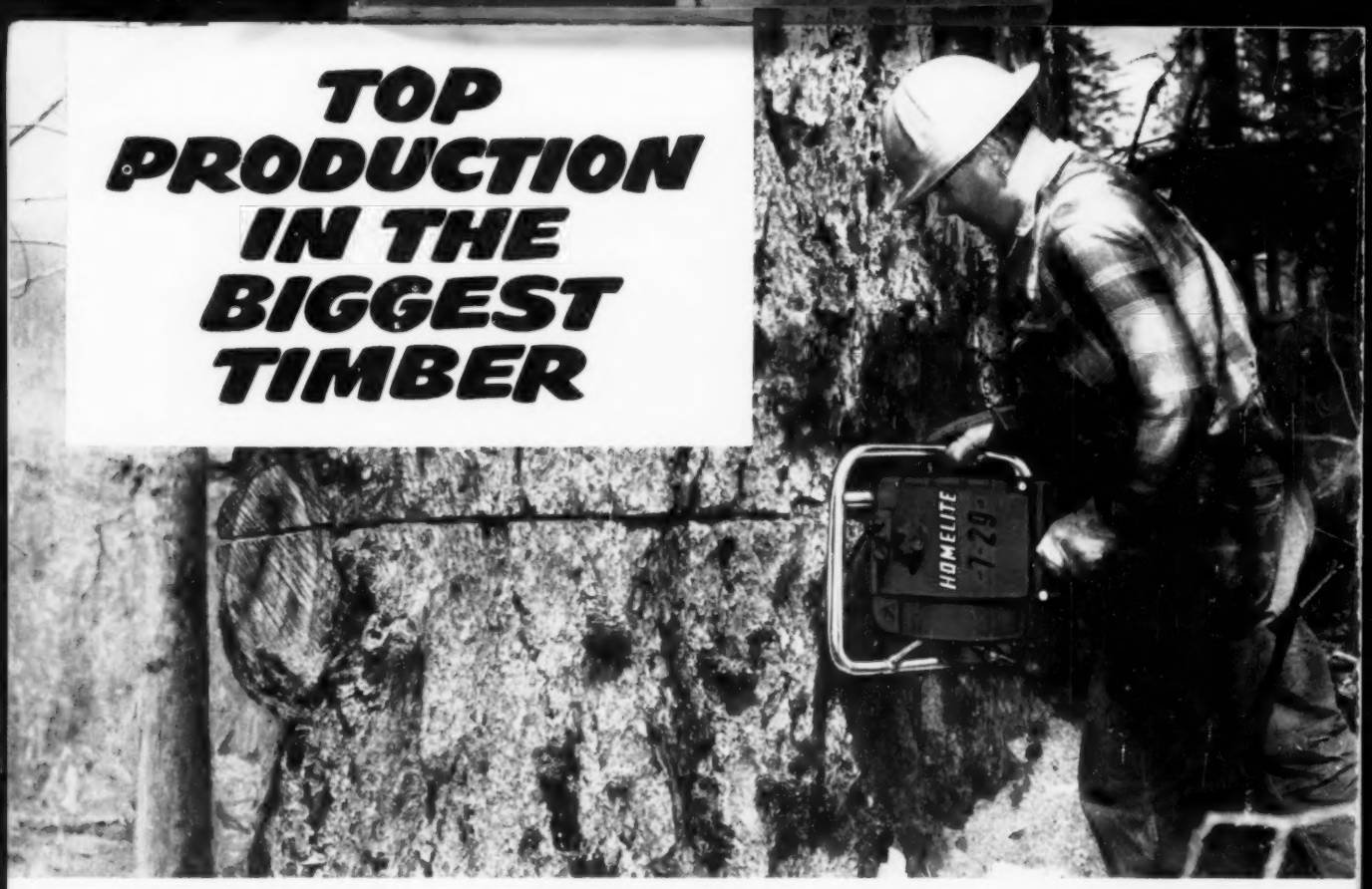

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